
TRAVELS
IN
ENGLAND, SCOTLAND,
AND THE
HEBRIDES.

VOL. I.

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ENGLAND, SCOTLAND,

AND THE

HEBRIDES.

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18 Feb 3

TRAVELS
IN
ENGLAND, SCOTLAND,
AND THE
HEBRIDES;

UNDERTAKEN FOR THE PURPOSE OF EXAMINING
THE STATE OF
THE ARTS, THE SCIENCES, NATURAL
HISTORY AND MANNERS,

IN
GREAT BRITAIN:

CONTAINING

Mineralogical Descriptions of the Country round Newcastle; of the
Mountains of Derbyshire; of the Environs of Edinburgh, Glasgow,
Perth, and St. Andrews; of Inverary, and other Parts
of Argyleshire; and of

THE CAVE OF FINGAL.

IN TWO VOLUMES WITH PLATES.

TRANSLATED FROM THE FRENCH OF
B. FAUJAS SAINT-FOND,

MEMBER OF THE NATIONAL INSTITUTE, AND PROFESSOR
OF GEOLOGY IN THE MUSEUM OF NATURAL
HISTORY AT PARIS.

VOL. I.

LONDON:

PRINTED FOR JAMES RIDGWAY, YORK STREET,
St. JAMES'S SQUARE.

1799.

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TRAVELS

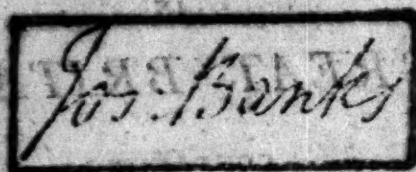
IN
ENGLAND, SCOTLAND,

AND THE

HEBRIDES:

ARRANGED FOR THE PURPOSE OF EXAMINING
THE STATE OF

THE ARTS, THE SCIENCES, NATURAL
HISTORY, AND MANNERS.



Illustrations of the Country and Towns, of the
Monuments of Distinguished Persons, of the
Ruins of Castles, Forts, and other Buildings,
of Agriculture, and of

THE CAVE OF FINGAL.

IN TWO VOLUMES, WITH PLATES.

R. LAURENCE SAINT-FOND,

MEMBER OF THE NATIONAL INSTITUTE, AND PROFESSOR
OF GEOLOGY IN THE MUSEUM OF NATURAL
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ERRATA AND ADDENDA.

VOLUME I.

IN page 11, M. Faujas states, that Klaproth in analyzing adamantine spar had found in it an earth peculiar to itself, and entirely *sui generis*, which he called *corrindonian* earth: but the author observes in a note at the end of his work, that that able chymist has since discovered this earth to be merely of the argillaceous kind.

The following is the new analysis of it:

Argillaceous earth	84	
Quartzose earth	6	50
Calx of iron	7	50
Lost	2	

100

In the next page the author observes, that Mr. Haüy had given the name of *Leisles* to the adamantine spar brought from China. That learned naturalist has, however, since abandoned that term.

Page 37, line 6, for *characterises* read *characterize*.

51, — 1 of the note, for *Depreaux* read *Despreaux*.

58, — 2, from the bottom, for *if should* read *it should*.

59, — 6, for *must* read *much*.

66, The author, in a note, mentions the number of the satellites which Mr. Herschel had discovered moving round the Georgium Sidus, which was then only two: When M. Faujas printed his tour last year at Paris he was not acquainted with Mr. Herschel's discovery of four more satellites.

Page

Page 69, line 16, for *had* read *has*.

81, — 3, for *has* read *had*.

128, — 17, dele *with*.

129, — 1, for *ear* read *are*.

136, — 21, for *part* read *pest*.

150, — 22, supply *is* after *this*.

168, — 8, read of *a* man's head.

237, — 17, for *here* read *her*.

257, — 1, for *abound* read *abounded*.

303, — 10, for *began* read *begun*.

312, — 7, supply *a* after *with*.

333, — 2, for *ar* read *argil*.

338, — 6, dele comma after *found*.

358, — 2 from the bottom of the note for *pininatis*
read *pinnatis*.

359, — 6, for *Pluknet* read *Plunket*.

In the First Volume the Printer has, by mistake, left blanks before the names of several of the Members of the Royal Society; but as they are characters well known in the literary world, it is unnecessary to point out here the manner in which their designations, &c. ought to be supplied.

The author, in a note, mentions the number of the plates which Mr. Henschel had discovered moving round the Georgian Sides, which was then only two: When M. F. was printed his four last years at Paris he was not acquainted with Mr. Henschel's discovery of four more.

PREFACE.

P R E F A C E

THE following Tour was prepared for the Press in the second year of the revolution; but the troubles of that period rendered it necessary to delay its publication. The laws have, however, at length, resumed their empire, and the sciences will soon follow in their train.

Of the influence of the shock which our revolution gave to Europe, England has experienced her share, and though the arts are not there reduced to the same distressed situation as in France, the war has impeded their progress, and they must languish until the restoration of peace. But happily for the English, they have lost none of those great men who adorn their country in the career of useful and elegant knowledge,

while

while we have had the misfortune to see a great part of ours cruelly assassinated.

These painful recollections have given to some of the notes that have been added to this work a melancholy, or perhaps, a peevish tone, which the reader, it is hoped, will excuse.—The injuries done to myself I bury in oblivion, but the sufferings of others I have not been able to forget.

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TRAVELS
THROUGH
ENGLAND AND SCOTLAND
TO THE
HEBRIDES.

CHAPTER I.

LONDON.

*Sir Joseph Banks.—Doctor Whitehurst.—Cavallo.—
Doctor Letsom.—Sheldon.—Royal Society.—British
Museum, &c.*

I DO not intend to entertain the reader, under this head, with observations on the extent, the beauty, or the immense population, of the city of London*: these have been fully treated of by others.

Natural

* Arthur Young, in his *Travels in France*, during the years 1787, 88, 89, and 90, a work full of new views and instructive facts respecting the population, com-

Natural history, the sciences, the arts, and some objects of commercial economy, will more particularly engage my attention. I proceed to the subject.

SIR JOSEPH BANKS.

THE house of this celebrated traveller, who is President of the Royal Society of London, is the rendezvous of those who cultivate the sciences; and foreigners are always received there with politeness and affability. They assemble every morning in one of the apartments of a numerous library, which consists entirely of books on natural history, and is the completest of its kind in existence. There all the journals and public papers, relative to the sciences, are to be found; and there they communicate to each

merce, and agriculture of France, compared to that of England, in speaking of the extent and population of the city of London, asserts, that London is so superior to Paris, as to render all comparison ridiculous; and that he believes, without any exaggeration, that this city alone is equal to Paris, Lyons, Bourdeaux, and Marseilles, as might be proved from the accounts of the population, riches, and commerce, of all these places. However much I esteem Arthur Young, I am not entirely of this opinion. London is, doubtless, more extensive and populous than Paris; but not in that proportion.

other

other such new discoveries, as they are informed of by their respective correspondents, or which are transmitted by the learned foreigners who visit London, and who are all admitted into this society.

A friendly breakfast of tea or coffee supports that tone of ease and fraternity, which ought universally to prevail among men of science and letters. They would, in general, become more sociable, and more intimately allied, if accustomed to see each other frequently; especially if they enjoyed, as in this city, a rallying point, presenting the charms of mild society in conjunction with those pure pleasures, which every thing connected with knowledge and instruction must always afford.

Sir Joseph Banks has rendered important services to the sciences, by his distant voyages, undertaken for the purpose of discoveries; he benefits them daily by the collections which have been the result of those voyages, particularly that of botany, the branch of natural history, in which he is most interested. His fortune also enables him to carry on an extensive correspondence with every part of the globe; and his kind

and communicative disposition admits others to participate in the fruit of all his new discoveries.

This friend of the sciences has hitherto published only the Collection of William Houston*, containing a number of American plants, and Kaempfer's Collection of the Plants of Japan; but he has been long occupied in designing and engraving, by the ablest artists, the plates of a superb collection of the plants of the South Sea; a valuable work, which is expected with impatience, and which will be worthy of the reputation of its author.

Sir Joseph Banks has made some precious acquisitions in botany, and has thence become the guardian of several herbals executed by naturalists of great reputation. Had it not been for the attention and fortune of Sir Joseph Banks, these collections of plants might have been dispersed in distant quarters, or, perhaps, lost by the negligence of heirs; whereas, united as they now are, in

* *Reliquæ Houstonianæ, seu Plantarum in America Meridionali, a Gulielmo Houston, collectarum icones manu propria incisæ, in bibliotheca Joseph Banks Affervati. Londini, 1781, in 4to. fig.*

one repository, they are easily accessible to such as incline to consult them.

It is with this view that he purchased from Mr. Dick, minister of the gospel at Bodligen in Switzerland, an herbal of the celebrated Haller, which comprizes the collections of plants made by the two brothers, Bauhins.

He has likewise acquired the plants of French Guiana, by Fufee Aublet, the herbal of Jacquin, and several others formed by those naturalists who have illustrated the botanical science.

At the time I had the pleasure of seeing Sir Joseph, he received from China a package, in which there was a box, containing a lapideous matter, reduced to powder, such as lapidaries employ in cutting and grinding hard stones, of the nature of rock-crystal, which the Chinese make use of as ornaments in their dress and furniture. The same box inclosed a small bag, containing some fragments of the stone of which this powder is made.

Europeans, in general, are acquainted only with two substances fit for sawing and polishing hard stones—the powder of diamond, for cutting the diamond itself, and the other

finer gems ; and that of emery, for jaspers, agates, rock-crystals, &c.

Several years before the transmitting of that parcel, Doctor Lind, during a short stay at Canton, employed himself in enquiries respecting the Chinese arts; and he spared neither pains nor expence to obtain information on that subject, notwithstanding the difficulties which he had to surmount.

He brought away with him some of the same powder, and one of the bows used by the lapidaries of China. It differs from that employed by Europeans, in having its string made of double wire, that is, of two pieces of wire intertwisted ; whereas ours consists of single wire only. The Chinese method deserves to be made trial of by our artists. Doctor Lind did not neglect to procure some specimens of the stone which supplies the powder for cutting ; and it so happened, that almost all the fragments which he obtained, were crystalized. The largest of these crystals was sent by Doctor Lind, in 1782, to Doctor Solander, who accompanied Sir Joseph Banks in his voyage round the world. This celebrated naturalist died a short time afterwards ; and Mr. Wolfe, an
able

able chymist, who purchased it at the sale of Solander's effects, very obligingly made me a present of it at Paris, in the year 1783, where I then had the pleasure of seeing him*. This is the same crystal which I lent to Mr. Brisson to ascertain its specific gravity, and which he has mentioned in his work on the Specific Gravity of Stones and Minerals.

It was by following the directions of Doctor Lind, that Sir Joseph Banks endeavoured to procure the powder and specimens of the stone from China, and that he succeeded in getting home the box, containing several pieces of it. Sir Joseph offered me my choice of such as struck my fancy, and gave me a sufficient quantity of the powder to enable me to make various experiments with it at Paris.

What attracted me most in the choice which Sir Joseph allowed me, were some pieces still adhering to portions of the stones in which this *adamantine spar* (as Doctor Lind calls it) is found. By their means, indeed, I was able to determine the nature of the compound substance that contains

* I gave this fine crystal to the national museum of natural history at Paris.

this stone, which, at first view, and from its lamellated contexture, resembles a felt spar. I think it is beyond doubt, that this substance is a species of granite, in which it exists in the form of crystals, of a greater or smaller size, and more or less perfect. These crystals are opaque, of a greenish-brown, and sometimes of a greyish-white, colour, and they attract the magnet. They ought, therefore, to be sought for in granite rocks, where it is probable they may be found; and, considering their usefulness in the art of cutting hard stones, it would be a desirable thing to discover them in the granites of France; we might then dispense with using emery, which we bring from abroad*.

Doctor

* The following is a list of the specimens which I selected from those sent to Sir Joseph Banks, and which I gave to the museum of natural history at Paris, together with the large crystal presented to me by Mr. Woulf.

1. Adamantine spar, of a brown colour, with rhomboidal truncatures in some parts.
2. Idem, adhering to lamellated mica, of a bright silver colour.
3. Idem, with a glossy black mica.
4. Idem, with greenish felt spar, black mica, and some spots of black schorl.
5. Adamantine spar, adhering to a greenish steatites, hard but smooth to the touch, and yielding an unctuous powder.

6. Idem,

Doctor Lind gave the Chinese stone the name of *adamantine spar*, because its lamel-
lated

6. Idem, with white steatites, soft and having a small mixture of mica.

7. With rosecoloured felt spar.

8. With ferruginous pyrites of a cubical form.

9. Crystal, mixed with adamantine spar, having on one of its sides an impression of a cubical pyrites.

10. Adamantine spar, in large irregular particles, adhering to like irregular particles of a reddish coloured quartz, and iron scattered in small laminæ.

It cannot be any longer doubtful, that the adamantine spar exists in a compound substance. Lametherie mentions the adamantine spar in his notes on the sciagraphy of Bergmann, p. 271, vol. 1, and, in imitation of Klaproth, gives it the name of corindon. This learned and esteemed friend, who seeks for truth only in all his enquiries, will not be displeased that I should correct a trifling error which he has committed on the subject of this stone, where he says, in speaking of its hardness, "that it equals only that of the rock-crystal at most, for rock-crystal cuts it sooner than it cuts the crystal; its hardness may, therefore, be considered as that of eleven to crystal." The following is a decisive answer upon that subject: it is a detailed account of the experiments which I caused the son of M. Fontaine, one of the ablest lapidaries in Paris, to make in the presence of M. Hoppe, a German, who is deeply versed in the knowledge of precious stones. This subject is of sufficient importance, from its novelty and utility, to justify my introducing in this place the result of these experiments.

" M. Faujas (Saint Fond) having sent to M. Hoppe a certain quantity of adamantine spar, to make comparative trials of it with emery, the latter applied for that purpose to M. Fontaine the son, whose talents are well
" known

lated texture, its crystallization, and its appearance on being broken, seemed to class it among the *spars*.

The generic term *spar*, which we have

“ known to every *amateur*, and who agreed, in the most
“ obliging manner, to satisfy the wishes of M. Faujas.

“ The principal operations of the lapidary on precious
“ stones being to cut, to drill, and to shape on the wheel, M.
“ Fontaine employed the adamantine spar instead of emery
“ in all these operations, and, that he might obtain more
“ certain results, with instruments which had not been in
“ use before.

“ Lapidaries cut and drill, in general, with powder of
“ diamond; to this the adamantine spar was much inferior,
“ but its effect was pretty conspicuous, and superior to
“ that of the enemy. M. Fontaine compared it to that
“ which the powder of ruby, sapphire, or oriental topaz,
“ might produce.

“ He then employed the powder of adamantine spar in
“ grinding and shaping on the wheel; and its effect sur-
“ passed, in a degree beyond all expectation, that of the
“ other substance. The result of a great number of ex-
“ periments was, that the lapidary's wheel retains very well
“ the adamantine spar, that it requires only a fourth part
“ of what would be necessary of emery to render it perfectly
“ fit for grinding, and that one-half of the time is saved in
“ the operation. It may be proper to add, that the ada-
“ mantine spar prepares stones better for receiving a polish
“ than emery, because the first produces a finer grain.
“ M. Hoppe having been present at all these operations,
“ took the above minute of the result of the comparative
“ experiments, and signs it with M. Fontaine,

“ HOPPE,

“ *Paris, May 30, 1789.* Fontaine the son, lapidary.”

from

from the Germans, our first masters in mineralogy, though insignificant of itself, ought not, however, to be rejected, as the partizans of the new nomenclatures would persuade us. On the contrary, it is because we perceive no particular meaning in the root of that term that it should be considered as a good one, when used in conjunction with an epithet; as, for example, *calcareous spar*, *ponderous spar*, *cubic* or *phosphoric spar*.

Klaproth, who has analysed the adamantine spar like an able chymist, has given it, for what reason I know not, the name of *corrindon*; and having discovered in that stone an earth peculiar to it, and entirely *sui generis*, united with quartz, iron and nickel, he has thought fit to call it the *corrindonian* earth. If the word *corrindon* were Chinese, I should be the first to adopt it, and to advise naturalists to preserve it, were it only to prove that the stone, and the use to which it is applied, have been transmitted to us by the Chinese. But this word has so little resemblance to the language of that people, that it must be presumed to be of European manufacture.

This

This rage for coining new words has seduced M. Haüy, a very able naturalist, to create one of a compound kind, in imitation of some chymists, who have endeavoured to compress the principles of science into its terms. He has, accordingly, called the adamantine spar *leiastes*, signifying *levigator* (polisher), on account of the use, says he, to which it is applied, of polishing stones. But M. Haüy should have considered, before he had formed a name taken from the properties of the thing itself, that the powder of adamantine spar is employed in cutting and sawing stones, and not in polishing them. It is to the *putty* and the *ruddle* of England, which are destined to give them their polish and lustre, that the name of *leiastes* would be most applicable. Let us, then, preserve to this stone that of *adamantine spar*, however imperfect it may be, until we have ascertained the name which it bears in China. In the mean time it will continue to be known, that Doctor Lind was the first who made us acquainted with it, and with its use among a people whose high antiquity and industrious application have given birth to a number of arts and processes, which might
be

be easily proved to be still unknown to Europeans.

The reader will, I hope, excuse the details into which I have entered respecting this stone : as it is an object still new in natural history, as it may be of advantage to the art of the lapidary, and as it is presumable that adamantine spar does not exist exclusively in the granites, or among the porphyries of China, I conceived that these considerations merited the attention of men of science*.

The package sent to Sir Joseph Banks contained another object not less worthy of attention, as it interests a more numerous class of men—that of those who are engaged in agriculture : it was a quantity of the seed of a species of hemp of a superior quality to that cultivated in Europe.

In the year 1781, M. Elliot, who resided

* It would be too long, and rather misplaced, to mention here the different analyses which have been made of this stone in France and Germany. M. de Bournon thought that he perceived some traces of it in a granite brought from Foret, on the coast of Montbrison; and others conceived that they had made a like discovery in other quarters. I intend, as soon as my avocations will permit, to investigate this subject completely in a separate essay.

some time at Canton, gave Mr. Fitzgerald from thirty to forty grains of this hemp seed. It was not sown until the 4th of June, which was about a month too late ; but, notwithstanding this circumstance, and the dryness of that season, the greater number of the plants rose to the height of fourteen feet, and the stems of several were so large, as to measure seven English inches in circumference.

These promising plants blossomed ; but on the approach of cold weather, they perished without yielding any seed. “ There
“ are,” says Mr. Fitzgerald, “ from thirty
“ to forty lateral branches on a plant ; they
“ were set off in pairs, one on each side
“ of the stem, pointing horizontally ; the
“ others, at about five or six inches distance
“ from them, pointing in different direc-
“ tions, and so on to the top ; the bottom
“ branches of some measuring more than
“ five feet, the others decreasing gradu-
“ ally in length towards the top, so as to
“ form a beautiful cone when in flower.”

After steeping them in the ordinary manner, he says, that “ on trying whether the
“ hemp could be easily separated from the
“ woody part, I was agreeably surprised to
“ find,

“ find, that on peeling a few inches longi-
“ tudinally from the root, the whole rind,
“ from the bottom to the top, not only of
“ the stem, but also of all the lateral
“ branches, stripped off clearly, without
“ breaking any one of them: the tough-
“ ness of the hemp seemed to be extraor-
“ dinary.—

“ The rough hemp that has been peeled
“ from the thirty-two plants, when tho-
“ roughly dried, weighed three pounds and a
“ quarter; but I do not think it had come to
“ full maturity, though I can hardly doubt
“ but the plants would have come to per-
“ fection, if the seed had been sown in the
“ proper season. The summer was re-
“ markably dry, notwithstanding which,
“ although the situation they were placed
“ in was very warm, and the ground not
“ rich, I found, on measuring the plants at
“ the different times, that they had grown
“ nearly eleven inches *per* week.”

Such is the substance of the paper com-
municated by Mr. Fitzgerald to Sir Joseph
Banks, which was read in the Royal Society
of London, on the 17th of January, 1782,
and printed among the philosophical trans-
actions

actions of that year. I conceived that my readers would peruse, with some interest, the history and result of the first experiment, though an incomplete one, which was made in Europe, on the hemp of China.

The desire of acquiring to England an object so important for her navy, which constitutes her power, engaged the attention of the government, and of those who wished to enrich agriculture with this new production. It was known that the exportation of this seed was severely prohibited in China. This prohibition, however, served only as a fresh stimulus to zeal and emulation; and, on the first return from the voyage to China, a vessel brought home about a pound of it, concealed in the box of natural history, addressed to Sir Joseph Banks, which contained the adamantine spar, and other curious objects. The President of the Royal Society was pleased to divide two ounces between Brouffonet, who was then London, and myself, in order to make trial of it in France, particularly in the southern departments, where both of us had estates. There was reason to hope that the seed would come to maturity in that climate, and that a second supply

supply might be got there, in case it should not succeed in England. We received this valuable present with suitable acknowledgments; and I resolved, on my return to Paris, to distribute some of it to able cultivators, and to reserve the remainder for the the south of France *.

WHITE-

* On my return to Paris, my first business was to give some grains to M. de Malesherbes, M. de Rosambo, his son-in-law, M. de Trudaine the elder, M. Boutin, M. de Lavoisier, M. Hell, for Alsace, Varenne de Fenille, for Bresse, M. Bouffon, for his estate of Montbard, in Burgundy, M. Thoin, for the botanical garden of Paris, and to M. Moral, physician, at Montelimar, who employs himself in agricultural pursuits. I reserved about fifty grains for the subsequent year, intending myself to direct the sowing of it, and to attend to its progress in the department of Drôme.

The hemp of China succeeded every where, even beyond expectation. That in the botanical garden of Paris was visited as a curiosity; in the month of August it was fourteen feet high, and from fifteen to sixteen in September. M. Hell wrote to me, from Alsace, that the stems of the twenty grains which he had sown, were seventeen feet high on the 20th of September, and that their lateral branches were so vigorous, and occupied so much space, that all the plants seemed rather trees than annual vegetables. This was the case also at Malesherbes, Montigny, in Burgundy, Bresse, and the other places. Every where male and female plants, of a promising blossom, made their appearance; but from Bourg to Paris, from Paris to the bailiwick of Landser, in Alsace, not one of them yielded

WHITEHURST.

Benjamin Franklin had the goodness to give me a letter of recommendation to his old

good seed ; the cold having prevented them from ripening. I was also informed, that all that had been sown in England had the same fate. This species of hemp was everywhere found superior to the common sort, in strength, in its silky texture, and in the length of its fibres. M. Thoin ventured to raise a few plants in turf, for the purpose of being put into pots, and placed in a green-house; so anxious was he to prevent this gigantic hemp from being lost. The seed acquired a certain degree of maturity; it was not very vigorous, but it was capable of reproduction. I had some hopes from the other places where it had been tried, and I particularly looked for an account of what had been sown in the vicinity of Montelimar. I learned, towards the end of September, that it had perfectly succeeded; that the dryness of the season prevented it from growing so high as it did elsewhere; but that the seed had acquired the proper ripeness, and that more than a pound of it had been gathered. I obtained the same success the following year from that which I kept in reserve, and which I sowed in the department of Drôme; the plants rose to the height of twelve feet. I have hitherto continued this branch of cultivation with much success, and it is evident that the hemp of China produces excellent seed in the south of France. I have already given quantities of it to several persons at Paris, and other places. It is of very great importance to avoid sowing it near the common hemp. I wait for peace to repay my obligation to the English; for it is no more than just to return that which they have so generously lent us. I should have published a long time ago the result of the experiments which I made myself, and those of the different persons to whom I had given part of the seed; but

old and estimable friend Whitehurst, who has illustrated, in the most ample detail, the wonderful and singular structure of the mountains of Derbyshire, in a work entitled "*Inquiry into the original State and Formation of the Earth, &c.*" by John Whitehurst. London, 1778." In 4to. fig. 1 vol.

He was a native of Derbyshire, and resided a long time in the principal town of that county. His views and his meditations were thus directed to the face of a country truly extraordinary, and interesting to naturalists.

Whitehurst formed himself at an epoch when this science was not far advanced. But if he has committed errors (and who is entirely free from them?) they are owing, not so much to the uncertain state of mineralogy at that period, as to a sort of religious awe and restraint which often fettered the pro-

but I have been prevented, I must confess, by the melancholy remembrance, which reminded me, that of eleven persons to whom I gave some of the seed from China, and who, with an enthusiasm for the public interest, devoted their whole attention to its cultivation, eight have been dragged to the scaffold, without respect for names signalized by virtue and talents. Bouffon was dead—they took his son—he was unrelentingly assassinated

gress of men of genius, and compelled them to trace immediate connexions between the multiplied revolutions of the globe, and the oriental cosmogony, delivered in the books of Moses.

Whitehurst had, many years before, fixed his residence in London, where he had it more in his power to prosecute his studies, and to cultivate the society of men of learning. This venerable old man was very tenacious of a discovery which he thought he had made in Derbyshire, of a number of currents of basaltic lava crossing in various directions banks of calcareous stone, which they seemed, in many cases, to have moved from their original position. The whole of the descriptive part of his book is excellent, and remarkably accurate.

“ You have,” said he to me, “ seen
“ several volcanised countries; you have
“ made the different substances, acted on
“ by subterraneous fire, your particular
“ study. I have not been able, from particular
“ circumstances, to travel out of
“ England, and to see volcanos in action;
“ but I conceived that I discovered in the
“ mountains of Derbyshire traces of subter-
“ raneous

“ raneous combustion so evident, that I
“ thought myself capable of building on
“ that basis a system relative to the ancient
“ state of the earth. I am anxious to have
“ my observations confirmed or rejected by
“ you.

“ Were it not for a sick female relation
“ in this place, who requires all my atten-
“ tion, I should quit every other employ-
“ ment to accompany you. I feel a great
“ privation in losing this opportunity; but
“ I will request you to be the bearer of a
“ letter for a physician at the mineral wells
“ of Buxton, who is a man of general in-
“ formation, and well acquainted with the
“ places described in my book.”

Manners of this affable complexion are calculated to render the sciences attractive; and, when one has the happiness to meet with such men, to procure esteem for those who cultivate them.

I found a remarkable resemblance between Mr. Whitehurst and his friend, Benjamin Franklin. His good-nature, his frankness, his admirable simplicity of manners, and mild philanthropy, engaged my attachment, and I visited him frequently. He had the

goodness to introduce me to the acquaintance of several men of science, and to conduct me to the houses of the ablest artists of London, with whom he was particularly intimate, and who often came to consult him. He carried his attention so far, as to divide with me a part of the minerals and fossils which he had collected, and on which he supported his system. His cabinet was not very considerable, his collection being confined to the productions of Derbyshire; but that assemblage of objects, proper to form the mineralogical description of a country, will always present an interesting spectacle to the scientific traveller.

I promised Mr. Whitehurst, that I should direct my particular attention to the mountains which he had described. He said, I should oblige him by writing to him from Buxton or Matlock, as soon as I had visited that part of the country, and telling him, without any reserve, what I thought of the toadstone, and the other stones which he regarded as volcanic. All the specimens which I saw at his house convinced me, that he had fallen into the same error with Lammannon, who, in the Alps of Champfaur, mis-
took

took *trapps* for pieces of lava; but I wished to see the places where they had been collected, before I should express my opinion on the subject. I acted in the same manner towards my industrious and adventurous friend Lammanon, who was convinced of his error a little before he set out on the voyage round the world with La Pérouse*, of

* Lammanon, who had great talents and a strong attachment to natural history, was so convinced of the existence of an extinguished volcano, which he imagined he had discovered in the mountain of *Droveire*, one of the high Alps of Champsaur, in Dauphiny, that he made a drawing of the crater, the currents of lava, in a word, the complete topographical plan of these supposed remains of a subterraneous fire in the Alps; where there exists not a single trace of a volcano. He transmitted to me from Turin, where he then was, the manuscript of the paper which he composed on this subject; and requested, in his letter, to know my opinion respecting the discovery. He sent to me, at the same time, the collection of the different substances which bore, according to him, the most evident marks of the action of volcanic fire. I had visited that mountain, in 1776, in company with the botanist Liotard, and I was already in possession of a collection of the stones which are found there, and which, at first sight, appear to resemble lava. I answered Lammanon's paper, article by article, and traced a parallel between these stones and the *trapps* of Sweden, of which I had a good collection. Lammanon, in his turn, refuted my objections in a very ingenious manner; and persisting in his opinion, on his return to Paris, printed at Euchet's, bookseller, Serpent-

of whose unhappy fate he was a fellow-sufferer.

CAVALLO.

Tiberius Cavallo is a native of Naples, but has been settled upwards of twenty years in London; his chief occupation is natural philosophy, in which he is profoundly skilled: he possesses much information, and displays singular dexterity in performing the most delicate experiments; he has carried electrometers to a degree of perfection, which

Hotel, Serpent-street, his paper, my letter, and his answer, with a plan of the places. This work was about to be published in 1784, when some learned Swedish mineralogists, to whom he communicated it, together with his collection, assured him that all those substances were varieties of *trapps*, absolutely similar to those of their country. Lammanon, who sought only for truth, acknowledged his error: he did more; he suppressed and destroyed the whole impression of his book, excepting twelve copies, to all of which he annexed a printed paper, containing an honourable confession of his mistake, and the name of the persons to whom he gave each of them. He was pleased to include me in the distribution. This book is a great rarity, as there are only twelve copies in existence, or more properly eleven, since the death of the author, who carried one with him on his voyage. The title of it is "*Mémoire Litho-Geologique sur la Vallée de Champsaur et la Montagne de Droveire, dans le Haut-Dauphiné, par le Chevalier de Lammanon. Paris, 1784, 8°. avec une carte.*"

renders

renders them sensible to quantities of the electrical fluid totally unapparent by ordinary instruments. I saw at his house thermometers, upon which the slightest change in the temperature of the air acted in a very remarkable manner, and by means of which he obtained divisions and graduations which had never been reached before. The tubes are extremely slender, and of a perfect bore, and the mercury is brought to the utmost degree of purity.

Cavallo has contributed greatly to that high degree of accuracy and perfection to which philosophical instruments have been carried in England. I must also do justice to the English artists; they enter upon their profession with much preliminary knowledge, resulting from a good education, which does honour to a country, where the majority of the people are in a condition to estimate the merits of able artists, and to put an adequate value on the productions which come from their hands.

Cavallo was, at one time, much occupied with aerostatic globes. He has translated into English, with notes and commentaries, all that has been written in France on that
astonishing

astonishing discovery, of which the progress has been interrupted only by the great expences requisite for experiments on a large scale; respecting which, however, we can never arrive at any beneficial and satisfactory results, without operating with vast machines, and employing the most extensive means. But the principle is known; and it is to be hoped that, sooner or later, it will be proceeded upon, and that some real advantage will be derived from a discovery, the value of which has not yet been generally enough felt*.

M. Cavallo shewed me a small, but simple and ingenious, apparatus to procure ice

* The French used an aerostatic globe of taffety, with great advantage, at the battle of Fleurus. The inflammable air introduced into it was obtained from a decomposition of water, by means of iron and a violent fire. It is the first time since men have fought against each other (and they have fought ever since they existed) that such a military machine was seen in the presence of an enemy: it was entrusted to the care of Cartelle, a man as intelligent as modest, who was captain of a company wholly destined to this service, and formed of young soldiers full of zeal and address. It was an agreeable sight to see them conduct, raise, lower, and manœuvre, in every direction, this moving observatory, which enabled the general-in-chief to contemplate, at one view, and to a great distance, all the dispositions and motions of the enemy,

quickly,

quickly, even in the hottest time of the dog-days, by the simple process of evaporation. This instrument consists of a small cylindrical tube of very thin glass, about four or five lines in diameter, and two and a half or three inches in length, open at one end, and shut at the other.

There is introduced into this tube, till it reaches the bottom, a wire of any metal, but very slender, and of a spiral form; water is then poured into it to the height of seven or eight lines. The metallic wire is intended to draw out the ice, when it is formed. Things being in this state of preparation, one of those small glass syringes with which children amuse themselves is taken; its extremity or beak should be of the smallest capillary size, and it should have no piston. A quantity of well-rectified vitriolic æther is then poured into this kind of funnel, and the upper orifice is stopped with the thumb to prevent the evaporation, and to force the volatile liquor to escape by the small end.

The æther soon trickles in very small drops from this lengthened bill, which is held over the cylindrical tube, containing the water to be converted into ice. The
æther

æther is thus made to fall on the exterior surface of the tube, which is held in the left hand, and turned about with the fingers, till the whole is wetted with the æther flowing from the syringe held in the right hand.

This liquor evaporates almost instantaneously, and carries along with it the caloric of the water, which is seen, in a little time, to assume consistence, and to pass into a state of congelation; the copper or iron wire is then withdrawn, and brings out with it a small cylinder of ice.

Franklin had made some very curious observations on evaporation, and the effects which it produces, and of the useful application which might be made of it for medical, and even economical, purposes; he has written some very interesting things upon this subject. The experiment of Cavallo is merely an application of this principle; but it is simple, and well adapted for philosophical demonstrations.

This experiment introduced a conversation on æther, in which I asked this learned philosopher a question relative to an article in Macquer's Chymical Dictionary, which gave occasion to several persons to attack that

that celebrated chymist, on the subject of dissolving elastic gum (or caoutchouc) in æther.

“ It is certain,” said I, “ that vitriolic
“ æther, as it is usually prepared, does not
“ dissolve elastic gum. But on the death of
“ Macquer, of whose chymical cabinet I
“ became the purchaser, I found three small
“ decanters, in one of which there was
“ elastic gum, perfectly dissolved in æther ;
“ of this, it would be easy to convince any
“ one. The other two contained some,
“ likewise, which appeared to be partly dis-
“ solved ; but it was precipitated to the
“ bottom in a state a little thicker than tur-
“ pentine, and was found incapable of mix-
“ ing with the æther in the bottle. That
“ which contained the elastic gum in a state
“ of perfect solution, had a label with this
“ inscription, in the handwriting of Mac-
“ quer : ‘ *Elastic gum, dissolved in æther, sent
“ from London.*’ I mentioned this, to be in-
“ formed whether you know any one in Lon-
“ don who has employed æther in dissolving
“ caoutchouc, and what were the ingredients
“ used in addition to it, or the preparation
“ which it received.”

“ You

“ You could not have addressed yourself,” replied Cavallo, “ to one able to procure
“ a more complete answer to your questions
“ than myself. We shall go, this morning,
“ to visit the workshops of some artists; and
“ as the person who discovered the process
“ for dissolving elastic gum is in our way,
“ we shall give him a call; your wishes
“ will thus be very soon gratified.”

I accepted his offer, and in about an hour after we went to the house of Mr. Winch, an apothecary, who received us with a great deal of politeness, and who told me that he was the person who had addressed to Macquer, at Paris, a bottle of elastic gum, well dissolved in æther, and that in a letter to the French chymist, he assured him that the æther did not contain the smallest mixture. Macquer, who found the elastic gum in perfect union with æther, of which the transparency was not in the least altered, and who, on examining the æther, found it to be totally free from any extraneous substance, sincerely believed that pure æther was the real solvent; and notwithstanding his succeeding but imperfectly himself, though he employed the best æther, he probably per-
suaded

suaded himself that what he used was still insufficiently rectified.

“ I did not, indeed,” said Mr. Winch, “ send him an account of the process which I used ; but it is nevertheless true, that the æther is unmixed, and that the whole depends on a very simple preparation.”

Cavallo, who is the friend of Mr. Winch, said, that he intended to perform the experiment the next day, at his own house, and that I should be a witness of it. It consists in the following process :—A pound of good vitriolic æther is taken, and put into a bottle, capable of containing about four pounds of any common liquid. On this æther there are poured two pounds of pure water ; the bottle is then stopped, held with the mouth downwards, and strongly shaken, in order to mix the two liquors. On discontinuing the shaking, the æther soon swims uppermost ; the bottle is still held in the same position, and cautiously opened, keeping the thumb on the mouth of it. The water is by this means easily let off, and collected in a vessel below. The same operation is repeated two or three times, with new quantities of water, until the sixteen ounces of æther are reduced to about

about five ounces. It is this purified remainder that is found to be the most perfect solvent of elastic gum, which is thrown into the æther, after being cut into small pieces. It begins to swell in a very short time; the æther penetrates it, and appears to act slowly on it at first; but at the end of five hours, or later, the liquor is saturated, and remains transparent. If there be a surplus of elastic gum, it subsides to the bottom; and, on being taken out of the bottle, may be moulded into any form, and will preserve its elasticity.

To shew how the part which is completely dissolved is to be applied to use, I shall describe the method employed by Cavallo to form a tube of elastic gum.

There is first prepared a small cylinder of pipe clay, of the diameter and length of the intended tube. It is not necessary to bake it, but simply to let it dry.

The æther, saturated with gum, is poured into a case of glass, or tin, which should be a little longer than the clay cylinder; this is filled up to the brim.

The operator then plunges the whole length of the clay pipe into the æther, withdraws it suddenly, lets it remain for an instant
in

in the air, replunges it anew, and repeats the operation in proportion to the intended thickness of the tube; for each immersion and evaporation produces a small coating.

This being done, the clay cylinder, covered, with elastic gum, is plunged into a vessel of water; the mould of clay is there speedily dissolved, and the gum remains in the state of a perfect tube.

This method of dissolving and using elastic gum is ingenious; and in one respect resembles that employed by the natives of America, who form all their works in elastic gum, on moulds of clay. It may be objected, that the process with æther is too expensive. The objection holds good with respect to ordinary purposes; but the elastic gum has been so usefully employed in surgery and some other arts, that there are circumstances, in which expence ought to be of no consideration. The process, also, for making æther is so simplified, that it is not half so dear as it was formerly*.

I should

* I should, doubtless, prefer, that we endeavoured to naturalize in Europe the useful tree, or rather trees (for it appears that there are several kinds of them), which yield the singular production of elastic gum. It ought in-

I should not forget to mention, that the water used in purifying the æther ought to be preserved, because a part of the æther mixed with it may be recovered by distillation.

I saw Mr. Cavallo frequently ; and it is impossible to be in his company without reaping instruction. He was pleased to make me a present of one of the electrometers which he has brought to such a degree of perfection, and which were not then to be

cessantly to be recommended to the naturalists employed by government on voyages of discovery, to direct their attention principally to the sending home plants and trees of well-ascertained utility. It is wonderful, that the cinchona (Peruvian-bark-tree), that admirable specific for a multitude of diseases, should still be confined to parts of Peru, where the temperature is not very different from that of many places in the south of France. I must do justice to the administration of the botanical garden of Paris ; they have not neglected this object. They have intelligent botanists in America and other places, who have sent home very useful articles ; and the economical branch of botany begins to be attentively cultivated by them. It ought not to be omitted, that this garden furnished the first coffee-plant to America. Two plants of that shrub were carried out by Declieu, who deprived himself, during a long passage, of a portion of his allowance of water, to preserve the only one which at last remained to him. It arrived, owing to his attention, in good condition at Martinique, where it produced that immense progeny which has supplied all the Antilles. The nation has a debt of gratitude to pay to the memory of this useful man.

found

found at the shops of the philosophical instrument-makers. He likewise gave me, with the same obligingness, a beautiful crystal of adamantine spar, which he had from Doctor Lind *. I took the opportunity to repeat my grateful acknowledgments of his kindness.

DOCTOR LETSOM.

This celebrated physician has a collection of birds, insects, and minerals, some of which are very curious; but of all the objects that are to be seen and admired at his house, the most interesting is, without contradiction, himself.

This friend of humanity, this virtuous quaker, was the first to give the example of emancipating the negroes from slavery, by setting at liberty all that were employed in his rich possessions in America.

He finds the most delightful recompence for this act of justice in the sensations of his own heart, and in the tender and filial attachment of those whose chains he has broken. They have become more insepara-

* I gave this crystal to the cabinet of natural history at Paris.

ble from him since they have had the liberty of leaving him when they please. Happy is the man who places his felicity in doing good to others ! We love to meet with such men. They console us for the injustice, and the cruelty of so large a portion of our species.

All the family of Doctor Letsom participate of his amiableness and candour ; every person with whom he associates is of the same description.

After employing a part of the day in administering comfort to his numerous patients, he returns home to share in the enjoyments of friendship, and assembles around him persons whom he loves, and by whom he is beloved.

I supped one evening with him, when some of the most lovely women of London were of the party. It is true, they were neither powdered nor perfumed, and had not, like most ladies, heads full of feathers, or artificial flowers ; but their beautiful hair floated with becoming gracefulness on handkerchiefs uncommonly white and fine. Their simple, but elegant, dress, was remarkable for the excellent quality of the stuffs which composed

composed it, and its only ornament was the charming countenances and unaffected graces of those who wore it.

Every thing in this house corresponded with that neatness and exquisite simplicity which characterizes the quakers. A young widow, of an elegant person, and highly-cultivated mind, was one of the company. Her agreeable vivacity formed a pleasing contrast with the mild and tranquil sensibility of the other ladies, all of whom, however, possessed information and talents.

We supped without napkins, a circumstance which is not uncommon in many houses in England; but the best kinds of beer, plain, though exquisitely flavoured, meats, and the choicest vegetables, were served up in proper vessels, of the most elegant form. The cloth was removed at the desert, and fruits, comfits, and other delicacies, with a variety of wines, in crystal decanters, were placed on a table of the finest mahogany. This is the luxury of the English. We drank more than once in champagne and claret, to the health of our fair companions, and they pledged us in madeira and constance. A lively, but de-

corous, gaiety, a frank and pleasing simplicity, animated this scene.

Tea, punch, and other liquors, came in their turn. We should have passed the whole night at table, had we yielded to the pressing invitations of the doctor. But, notwithstanding his sollicitations, the party broke up at one o'clock. During the remainder of the night, I meditated how I should become a quaker; for, if happiness can be found anywhere on earth, it is among these worthy men.

JOHN SHELDON.

There are good physicians in Paris, but there are more in London who excel in the practice of medicine. The useful art of curing, or correcting the diseases and infirmities which afflict mankind, requires a preliminary education, so long and so laborious, and depends so much upon the most profound kind of knowledge, that we cannot set too high a value upon him who fills this honourable function with distinction.

The English are more wealthy than the French, and perhaps this is the reason why
they

they are oftener sick. In London in particular, where neither the food nor the climate are so salubrious as in Paris, physicians find much more employment, and are better rewarded for their labour, than with us. This profession is highly respected, and it is at the same time very lucrative.

The surgery of the French school is the first in Europe ; by the word school I mean the admirable manner in which the French surgeons explain and practise all the branches of their profession ; in which they so trace and apply the innumerable ramifications of anatomy, as to enable them to proceed with confidence in the art of curing, and in performing operations which are often terrible to the feelings, but almost always certain and successful in their effects. Thus pain is relieved by pain, and instruments of death are employed in giving life to man.

By what I have said above, I am far from intending to insinuate that there are not justly-celebrated surgeons in London, and other parts of the three kingdoms. I shall have occasion to mention several of them.

I was particularly desirous of seeing those who had made comparative anatomy their study, a subject so intimately connected with natural history.

I had to regret the absence of Doctor Hunter, who was at this time in the country, but I often visited John Sheldon, and some other anatomists of merit. Mr. Sheldon has one of the finest anatomical cabinets in existence. He is known by some excellent publications, particularly a work on the lymphatic vessels, ornamented with magnificent engravings.

This learned anatomist, animated with the passion of prosecuting still farther his enquiries respecting the lymphatics, resolved to encounter the fatigues, and to brave the dangers, of the whale fishery, in order that he might have the opportunity of dissecting the very apparent vessels of these enormous animals.

One must have seen and been well acquainted with John Sheldon, to be able to appreciate his extraordinary passion for study, or the activity of his mind, unceasingly animated by the vivacity or the fervour of his character. There was none

of

of the English gravity about him. I love to meet with such exceptions; but I know that he who is by lively and vigorous conceptions elevated to great undertakings, who labours with ardour, and unites a variety of information to an aptitude and passionate desire for knowing much, cannot have the same uniformity of character, nor act in the same systematic manner with common men.

Sheldon, whom I saw frequently, interested me the more, as he joined to a vivacity, which persons of a colder character might think extravagant, the most estimable qualities.

The discovery of air balloons, excited his enthusiasm. He no sooner learned what had been done at Paris on this subject, than he suspended a part of his anatomical labours, to make calculations respecting the gravity of the atmosphere. He afterwards directed his enquiries to the discovery of the most proper substance for making the covering of balloons, to improving the varnish, and to the inventing of the most convenient apparatus for simplifying and perfecting these machines. He visited all the shops and
manufactories

manufactories of London, to gain information on these subjects. He told me that he intended to go to France soon, in order to pay his respects to Montgolfier, Pilatre and Charles ; and to see the improvements they had made in the art of aërostation.

But his active mind did not permit him to wait so long before he carried his favourite design into execution, and, in concert with Major Gardiner, he constructed an aërostatic globe in Lord Foley's garden. This balloon was made of varnished linen, and was fifty-six feet in diameter. It was filled with air, rarified by fire. He informed me that he meant this merely as a trial, upon a small scale, calculated to enable him to study this machine ; but he was of opinion that experiments would be more satisfactory if they were made, as he hoped they one day would be, upon very large aërostatic globes.

The anatomical cabinet of Sheldon contains a great variety of curious preparations. I dedicated several mornings to visiting it, and examining a number of valuable designs made by able artists ; but nothing in this collection interested me so much as a
kind

kind of mummy, which was very remarkable in two respects: first, on account of the subject itself, of which I shall soon speak; secondly, with relation to the manner of the preparation, and the particular care with which it had been made. It occupied a distinguished place in the chamber where this anatomist usually slept; and he was particularly fond of this work.

I was introduced into a very handsome bed-room; a mahogany table of an oblong form, stood in the midst of it, facing the bed.

The top of the table opened by a groove, and under a glass-frame I saw the body of a young woman, of nineteen or twenty, entirely naked. She had fine brown hair, and lay extended as on a bed.

The glass was lifted up, and Sheldon made me admire the flexibility of the arms, a kind of elasticity in the bosom, and even in the cheeks, and the perfect preservation of the other parts of the body. Even the skin partly retained its colour, though exposed to the air.

It appeared to me, however, that the fleshy parts were rather dry, and that there
was

was too great a tenderness of the muscles. This gave to the figure, though it still possessed the remains of beauty, a meagre and feeble air, which considerably diminished the delicacy of its traits.

Sheldon informed me that this was partly occasioned by the long sickness of which the young woman died.

He explained to me the manner in which this preparation had been made. He injected several parts of the body with strong spirits of wine, saturated with camphire, and mixed with a small quantity of turpentine.

The skin was prepared and tanned, as it were, with finely powdered alum, rubbed on with the hand. The intestines were taken out, and covered with a varnish, composed of a mixture of camphire, and the common rosin. The same thing was done to all the internal parts of the body, which were afterwards passed over with alum.

Sheldon assured me, that pulverized camphire, mixed with rosin, formed an excellent composition for preserving the flesh, and other soft parts. After having placed all the viscera thus prepared in the body, he
then

then injected the crural artery with a strong solution of camphire, in rectified spirit.

Wishing afterwards to imitate the natural tint of the skin of the face, a coloured injection was pushed through the carotides, to produce that effect.

In this state of things the body was placed in the table of which I have spoken; but within a double case of timber. The first is made of Virginia cedar (*Juniperus Virginiana*). The inner bottom was covered with calcined chalk, to the thickness of one inch, in order to absorb all humidity. Upon this bed the body was extended. The box, or case, was then carefully shut up, to secure the body from the impression of the external air.

The box was not opened until five years after the preparation was made. It was then observed to be in the same state of preservation in which it was first enclosed. No mark of decay appeared, and no insect had introduced itself near the body. The box had been several times opened when I saw it; and though this mummy at that time still possessed elasticity in several parts,
it

it is to be supposed that the action of the air will at last completely wither it.

A sentiment of curiosity made me ask Sheldon, at the moment when he was closing up the table, who this young woman was, whose remains he had preserved with so much care. He replied frankly, and without any hesitation, "It is a mistress whom I tenderly loved. I paid every attention to her during a long sickness, and a short time before her death, she requested that I should make a mummy of her body, and keep her beside me.—I have kept my word to her."

I was glad that Sheldon had not informed me of this circumstance sooner, for I confess I could not have avoided experiencing a disagreeable feeling at seeing a lover coolly describe the anatomical operations which he had made on the object of his most tender affection; on a charming young woman whom he had lost, and whose disfigured image could only excite in him the most painful recollections.

I can conceive that there might be a pleasing consolation, a sort of veneration and religious

religious respect, which would extend itself beyond the limits of life, if we were, as in ancient Egypt, in the practice of preserving the remains of our relations, friends, and all those who are most dear to us; but who would, with his own hand, perform the disgusting operations which must be necessary to preserve the body of his friend? I avow I should almost be tempted to act like the Egyptians, who stoned those who executed this melancholy business.

But the learned Sheldon does not merit so severe a treatment. He is gentle and compassionate; and I certainly deceived myself, and was wrong in regarding this kind of courage on his part, as an act of cynicism: besides, well-informed persons in London, who were acquainted with this transaction, assured me that it required great strength of mind in Sheldon, to overcome his sensibility. Let us quit, however, this dismal subject, and proceed to describe the dinner which I had with some of the members of the Royal Society.

THE DINNER OF AN ACADEMIC CLUB.

ABOUT forty members of the Royal Society have been, for more than twenty-five years, in the habit of dining annually in one of the taverns of London. Each member has the right of bringing to this club two visitors, whom he chooses, among foreigners, or the friends of the Royal Society of his own acquaintance. The president may bring a greater number, and can select whoever he pleases for guests.

We sat down to table about five o'clock. Sir Joseph Banks presided, and filled the place of honour. No napkins were laid before us; indeed there were none used; the dinner was quite in the English style.

A member of the club, who is a clergyman (I believe it was the astronomer Maskelyne), made a short prayer, and blessed the company and the food. The dishes were of the solid kind, such as roast beef, boiled beef and mutton prepared in various manners, with abundance of potatoes and other vegetables, which each person seasoned as he pleased with the different sauces which were placed on the table.

The

The beef-steaks and the roast beef were at first sufficiently drenched by large quantities of strong beer, called porter: it was drank out of cylindrical pewter pots, which are, by some, thought preferable to glasses, perhaps because they enable one to swallow a whole pint at a draught.

This prelude being finished, the cloth was removed, and a handsome and well-polished table was covered, as if it were by magic, with a number of fine crystal decanters, filled with the best port, madeira, and claret; this last is the wine of Bourdeaux. Several glasses were distributed to each person, and the libations commenced on a grand scale, in the midst of different kinds of cheeses, which, rolling in mahogany cases from one end of the table to the other, provoked the thirst of the drinkers.

To give more liveliness to the scene, the president announced the health of the prince of Wales: this was his birth-day. We then drank to the electorpalatine, who was that day to be admitted a member of the Royal Society. The same compliment was next paid to us foreigners, of whom there were five present.

The members of the club afterwards

saluted each other, one by one, with a glass of wine. According to this custom, one must drink as many times as there are guests, for it would be thought a want of politeness in England to drink to the health of more persons than one at a time.

A few bottles of champagne soon put all the company in good humour. The tea came next, with butter, marmalade, and all its usual accompaniments: coffee followed, humbly yielding precedence to the tea, though it be the better of the two. In France, we commonly drink only one cup of good coffee after dinner; in England they drink five or six times that quantity of the most detestable kind.

Brandy, rum, and some other strong liquors, closed this philosophic banquet, which terminated at half past seven, as there was to be a meeting of the Royal Society at eight o'clock. Before we left the club-room, the names of all the guests were written on a large sheet of paper, and each of us paid seven livres four sols French money: this was not dear.

I repaired to the Society along with Sir Joseph Banks, ——— Cavendish, Dr. Maskelyne,

kelyne, ——— Aubert, and Sir ——— Englefield; we were all pretty much enlivened, but our gaiety was decorous.

Doubtless, I should not wish to partake of similar dinners, if they were to be followed by settling the interests of a great nation, or discussing the best form of a government; such a conduct would neither be wise nor prudent; but to meet, to celebrate the admission of an elector palatine, who has, besides, much merit, to a learned society, is not a circumstance from which any inconvenience can result*.

THE

* The great Corneille, Moliere, Depreaux, La Fontaine, and Racine, used to take a bottle now and then in a tavern; and they were neither the worse friends, nor the worse poets, for it. How much is it to be wished that some men, who have had sufficient influence in France to destroy the academies by loading them with calumnies, and power enough to re-establish them by bestowing on them their praises, instead of flying and abandoning, in the times of misfortune, their unhappy brethren, had sought to assemble them in convivial, but modest, banquets, where their union might have been intimately cemented, and where they might have sworn to defend, with courage and with the arm of genius, the sacred rights of justice and violated humanity: then afflicted France, and indignant Europe, would not have had to regret those illustrious and unfortunate victims, which have been delivered up to ferocious tigers; and we should still have counted, among

THE ROYAL SOCIETY.

The room in which the meetings of this society are held, is in the old palace of Somerset-house: it appeared to me much too small. It is not long since this part of the palace was rebuilt; but notwithstanding the freshness and elegance of the decorations, the room wants that noble and severe character which ought to distinguish a place consecrated to the sciences: it resembles a concert-hall rather than a Lyceum; and the manner in which the seats are disposed, tends to encrease this resemblance.

The seats are only simple benches, with backs, ranged in parallel lines, and occupying the whole of the room. The president and the secretaries have alone distinguished places. The former is seated in an elevated chair, of a colossal form. It is made of mahogany, and surmounted with an escutcheon, on which are painted the insignia of the society. Nothing can be in a more gothic or worse taste than this ornament.

The table, which is before the president's
the learned men who honour their country, Malesherbes,
Bailly, Lavoisier, Condorcet, and many other philosophers
and artists, who have been cruelly butchered.

chair,

chair, is elevated, and covered, one cannot tell why, with an enormous cushion of crimson velvet. Before this, there is a second table, destined for the secretaries, upon which there lies a large mace of gilded wood, or metal. This is the symbol of all the royal institutions.

The society was assembled precisely at eight o'clock. Sir Joseph Banks presided, and — Blagden was one of the secretaries. The strangers were placed near the members who introduced them; and, however little known they might be, every member behaved to them with the greatest politeness and affability*.

The president first read the names of the strangers admitted that night, and the names of the members who had presented them. He afterwards proposed the Elector Palatine as a candidate for a vacant place. The

* The detractors of the English character, have reproached them with behaving in a cold and surly manner to foreigners. What has been considered as coldness, is, perhaps, only a proper reserve. Strangers were politely and honourably received in this learned society, and placed by the side of the members with whom they were fraternally confounded. The sciences, like the muses, should be regarded as sisters, and ought to know no distinction of country or of government.

elector was admitted with applauses. When this business was finished, the meeting broke up.

Some members whom I had the honour of knowing, engaged me to go next day to Greenwich, to see the Observatory, where a committee of the society was to meet, by the order of the government, to examine the state of the astronomical instruments: it is the practice to form committees of this kind annually; for in this country whatever is connected with naval affairs, becomes an object of general attention, and is never lost sight of for a moment.

After this visit, there was to be a dinner in the country; and Herschel, who was one of the committee, was expected to be there. I was to be introduced to this illustrious astronomer, and I had some hopes that he would not refuse me the favour of seeing the large telescopes in his observatory in Windsor Forest.

THE OBSERVATORY OF GREENWICH.

This useful institution, which is consecrated to astronomical observations, is situated on a hill, about seven miles from London.

don. I went there in a coach, which arrived in about an hour and a half.

The observatory is built on the most elevated part of the hill; and it affords one of the finest views imaginable.

The Thames flows at your feet, lined up to London-bridge with deep rows of vessels. Streamers waving in the air—ships under sail, going up and down the river—an immense multitude of men of all nations on this floating city—the more remote masts mingling with the steeples—the church of St. Paul, whose dome and fine proportion excite admiration even at this distance—Westminster Abbey, with its towers and Gothic architecture—the column, called the Monument, rising to the height of two hundred and two feet—all these grand and magnificent objects form a most enchanting picture, the true point of view for which is from the observatory of Greenwich.

The observatory is built of brick, in a style of the greatest simplicity. Magnificence and research are displayed in the inside only in the perfection of the instruments, which nothing can exceed.

I found the committee assembled, and

Doctor Maskelyne, the keeper of the observatory, had the goodness to shew me, in detail, the most remarkable objects in that rich collection.

The truly learned are easily distinguished by their manners. Nothing can equal their complaisance and affability; for the cultivation of the mind softens the manners, as that of the earth renders its productions more delicate. The man of science, or of literature, who should appear proud, haughty, or self-sufficient, would be very disagreeable; and whatever his pretensions may be, he must always seem to the man of sense an unsocial being, possessing only a mediocrity of talents. Great timidity, habits of retirement, and the importunities to which celebrated men are exposed, may, indeed, give them a cold and reserved air; but the difference is easily distinguished.

Doctor Maskelyne added to his other kindnesses that of introducing me to Mr. William Herschel, who invited me to see his observatory, and the large telescopes of his construction, in the country. We appointed a day for this visit.

The committee having finished their business,

ness, we all assembled in a tavern, in the neighbourhood. There were about thirty persons at table. The dinner was served in the English manner, and seasoned, according to custom, with a preliminary benediction on the guests and the victuals. The repast was excellent, and the company were gay and extremely agreeable.

We rose from the table about seven o'clock, not to depart, but to pass into another room, where tea, coffee, and all their usual accompaniments, were disposed with much show, upon a large table. The tea is always excellent in England; but nowhere do people drink worse coffee. It would appear, that the English are little sensible of the delicious flavour of this agreeable liquor, which nature seems to have created to solace at once the body and the mind: it is not only grateful to the stomach, but reinvigorates the understanding when one is fatigued with too intense thinking. Voltaire, who was extremely fond of coffee, called it the *quintessence of the mind*.

Why then does the English government, for political and commercial reasons, prevent the people from using coffee, which they might prepare according to their own taste,

taste, and compel them to purchase a kind of inferior quality, and bad flavour, from dealers who have it long in their possession after it is burned? One would imagine that it has been purposely contrived to render this liquor disgusting in a country where it is so necessary for removing melancholic humours—where the atmosphere is covered with an almost continual gloom—and where, if we may believe the celebrated Fielding, there is more port wine drank in one year, than the whole kingdom of Portugal produces in three.

It would certainly be far better policy to substitute for tea, which is brought from China, the coffee which grows in the English colonies: such a change might, perhaps, tend to diminish that alarming consumption of wine which occasions in this country so much inebriety, and so many diseases.

I beg pardon of the reader for this digression, which is somewhat foreign to my subject: but I was so disgusted with the bad coffee which I found, even in the most opulent houses of London, that, on account of my attachment to the better kind of that liquor, I could not avoid paying it this small tribute of gratitude, or, if should be called so, of epicurism.

CHAPTER II.

Sir Joseph Banks's Country-house.—The Observatory of William Herschel, near Windsor.—His large Telescopes.—Miss Caroline Herschell, his Sister.

ON the 15th of August, I made a pleasant excursion to the country-house of Sir Joseph Banks, about ten miles from London. I saw his gardens, and observed, in several instances, a cultivation and management which must interested me. I was shewn a beautiful bird, which had never before been brought alive to England; it was the green pigeon of the island of Nicobar: his plumage was of a deep green, and a brilliant lustre. The liveliness of his character was as striking as that of his colour: he was bold, petulant, and had none of the gentle manners which belong to the family of the dove; but this fine bird is not the less interesting, that it differs so much from every other species of the pigeon. It is of the size
of

of an ordinary dove, but the body is longer, It is said to be very delicious food*.

Sir Joseph Banks informed me, that the seamen who had brought away several of these birds from the island of Nicobar, intending to sell them in England, could not resist the temptation of eating them during their voyage. This one had accidentally escaped from being devoured, and was the only one saved out of a considerable number.

It were to be wished that they had left him a companion: this superb species would, perhaps, have been propagated in Europe; at least, the experiment might have been made.

At seven in the evening, after an elegant dinner and desert, at which there was abundance of pine-apples, I took leave of Sir Joseph, and set off to meet William Herschel, who expected me. Count Andreani and William Thornton were of the party.

* *Columba Nicobarica*, of Linnæus, *Syst. Nat.* page 283, 27.—*Columba Nincombar Indica*, of Klein, page 120, 28.—*Pigeon of Nincombar*, of Albin, vol. iii, page 20, with the figure of the male; plate 47, the figure of the female; both badly coloured.—*Pigeon of Nincombar*, of Brisson, vol. i. p. 153, 44, no figure.—*Pigeon of Nincombar*, of Edwards; *History of Birds*, plate 339, a very good figure.

The house in which Mr. Herschel makes his observations stands at one end of the forest of Windsor, and is about twenty miles distant from the house of Sir Joseph Banks; but, with good horses, and in an English chaise, the journey may be performed in three hours.

This was about the time when highway-men usually come upon the road, to prey upon the imprudent traveller. They are numerous, and perform their dangerous business on horseback; some of them are even mounted on hunters; but we were informed that, though our danger would have been great on the evening before, we were safe that night, which was Sunday, as the road was covered with people of all ranks, who, having passed the day in the country, were returning to London, to be ready to resume their usual occupations on Monday morning.

The evening was most beautiful, the air was calm and mild, and the sky sparkled with stars: the road was as carefully made, and as smooth, as the avenue of a public walk. It was bordered with quickset hedges, almost all in flower, and serving to inclose

inclose charming gardens and parks, ornamented with beautiful trees, in the midst of which were scattered so many simple, but elegant houses, that they seemed to dispute the ground with each other.

The road was, at this time, covered with a multitude of men and women, on horseback and in coaches. Carriages of every kind, most of them very elegant, but all of them substantial and commodious, and many of them, with superb equipages, succeeded each other without interruption, and with such rapidity, that the whole seemed the work of magic: it certainly announced an opulence and population, of which we can have no idea in France. All was life, motion, and activity; and, by a contrast only to be seen in this country, all was calm, silence, and order. A tacit and inviolable respect for each other seemed to regulate the individuals composing this impetuous mass of population, which was directed to one point. A scene so extraordinary, faintly illuminated by the stars, transports one, who sees it for the first time, into the fields of Elysium.

But the story of Elysium is fabulous, and
that

that which I have related is real; for it is what I have seen, and what all Englishmen, and those who know their country, will acknowledge to be a just description. How then does it happen, that so much tranquillity and order is preserved among an immense multitude of persons in motion? It has its origin in the state of the public mind, which is well formed; the education, which is good; and even the forms of worship, which are here stripped of much of that vain superstition they have in Roman Catholic countries, and which permit the day, consecrated to repose, to be passed in innocent relaxation.

I arrived at Mr. Herschell's about ten o'clock. I entered, by a staircase, into a room which was decorated with maps, instruments of astronomy, and natural philosophy, spheres, celestial globes, and a large harpsichord.

Instead of the master of the house, I observed, in a window at the farther end of the room, a young lady seated at a table, which was surrounded with several lights; she had a large book open before her, a pen in her hand, and directed her attention alternately

ternately to the hands of a pendulum-clock, and the index of another instrument placed beside her, the use of which I did not know: she afterwards noted down her observations.

I approached softly on tiptoe, that I might not disturb a labour, which seemed to engage all the attention of her who was engaged in it; and, having got close behind her without being observed, I found that the book she consulted was the Astronomical Atlas of Flamsteed, and that, after looking at the indexes of both the instruments, she marked, upon a large manuscript chart, points which appeared to me to indicate stars.

This employment, the hour of the night, the youth of the fair student, and the profound silence which prevailed, interested me greatly. At last she turned round her head, accidentally, and discovered how much I was afraid to disturb her; she rose suddenly, and told me she was very sorry I had not informed her of my arrival, that she was engaged in following and recording the observations of her brother, who expected me, and who, in order that he might not lose the precious opportunity of so fine a night, was then busy in his observatory.

“ My

“ My brother,” said Miss Caroline Herschel, “ has been studying these two hours ;
“ I do all I can to assist him here. That
“ pendulum marks the time, and this in-
“ strument, the index of which communi-
“ cates by strings with his telescopes, in-
“ forms me, by signs which we have agreed
“ upon, of whatever he observes. I mark
“ upon that large chart the stars which he
“ enumerates, or discovers in particular
“ constellations, or even in the most distant
“ parts of the sky.”

This fraternal communication, applied to a sublime but abstruse science, this constancy of study during successive nights, employed in great and difficult observations, afford pleasing examples of the love of knowledge, and are calculated to excite an enthusiasm for the sciences, since they present themselves under an aspect so amiable and so interesting.

Mr. Herschel's observatory, to which I repaired some moments after, is not built on an eminence, nor on the top of a house ; he has preferred placing it on a verdant plain, where the wind is not so likely to shake his instruments, and which is suffi-

ciently extensive to permit all the motions such large machines require.

His telescopes are elevated in the air, and mounted in a most simple and ingenious manner: a young man is placed in a kind of chamber below, who, by the means of machinery, turns the telescope and the observer together in a circle, with a gradual motion corresponding to that of the earth; thus the reflexion of the star observed is retained on the metallic mirror.

These large machines are, besides, constructed with that precision, solidity, and care, which renders them capable of bearing the intemperateness of the air; and the mirrors are so disposed, that they can be taken out and replaced at pleasure, with the greatest facility, notwithstanding they are of considerable weight.

Here I saw that ever-memorable telescope with which the eighth planet was discovered*. Mr. Herschel gave to it the

* It was discovered in 1781; its motion is from west to east, like that of the other planets. By observing it attentively with the largest telescopes, Herschel has discovered two satellites moving round the planet, in orbits nearly circular, and almost perpendicular, to the plane of the ecliptic.

name of the King of Great Britain, and called it *Georgium Sidus*. But all astronomers, actuated by a feeling of general gratitude, have, with one unanimous voice, unbaptised it, and given it the name of *the planet of Herschel**.

This telescope, with which I had the pleasure of making observations during two hours, is only seven feet long, and six inches six lines in diameter. Mr. Herschel assured me, that he had made more than one hundred and forty mirrors with his own hands, before he reached that degree of perfection, to which he at last brought them. A telescope of six feet length is placed beside this one.

This celebrated astronomer has not confined the size of his telescopes to the last measure; there are two others, which are twenty feet long, mounted on large stand-

* Laplace, in his learned work, the *Exposition of the System of the World*, calls this planet *Uranus*. My correspondence with the members of the Royal Society of London having been suspended since the commencement of the war, I am ignorant of the reason of this change; but I presume, that it is owing to the modesty of Mr. Herschel, who has, doubtless, refused an homage so justly, and so universally, paid to him by the learned world.

ards, rising above the house. The diameter of one of these telescopes is eighteen inches three-fourths, and the mirror weighs one hundred and fifty pounds.

As these superb instruments are of the Newtonian kind, which require the observer to be beside the object-glass, Mr. Herschel has constructed an apparatus of ingenious mechanism, by which the farther end of the telescope can be reached with ease and safety. There the observer finds a turning chair so disposed, as to enable him to sit at his ease, and follow the course of the stars. A domestic, placed below the telescope, by means of an ingenious combination, moves it softly and gradually along with the observer, and all the apparatus.

Thus William Herschel has been enabled to discover, distinctly, those innumerable stars, which form the most pale and distant part of the galaxy.

With these instruments he has been enabled to observe that multitude of double stars, as well as so many nebulae, with respect to which astronomers had only vague and uncertain notions; with them, too, he has undertaken

undertaken to count the stars of the sky, and has made most astonishing discoveries.

Placed at the upper end of his telescope, when the indefatigable astronomer discovers in the most desert parts of the sky a nebula, or a star of the least magnitude, invisible to the naked eye, he informs his sister of it, by means of a string which communicates with the room where she sits; upon the signal being given, the sister opens the window, and the brother asks her whatever information he wants. Miss Caroline Herschel, after consulting the manuscript tables before her, replies, brother, search near the star *Gamma, Orion*, or any other constellation which she has occasion to name. She then shuts the window, and returns to her employment.

That man must be born with a very great indifference for the sciences, who is not affected by this delightful accord, and who feels not a desire that the same harmony should reign among all those who have the happiness to cultivate them. How much more rapid would their progress then be!

We commenced our observations with the *Milky-way*.

The telescope of twenty feet discovered

to us, in the palest and most distant part of the heavens, an immense number of bright stars, quite distinct and separate from each other.

Mr. Herschel then directed the instrument to the star in the foot of the Goat, which emitted so strong a light as to affect the eye. On making its light fall upon a paper written in very small characters, we could discern and count the lines with ease. It is curious thus to distinguish objects by the glimmering of a star, that is, a sun many hundreds of millions of miles removed from the confines of our system.

The double stars, which are not visible with the most powerful acromatic glasses, appear separate and very distinct, when viewed with the telescope of twenty feet long.

Mr. Herschel made me observe the nebulae of M. Mercier, at first with the telescope of seven feet, that is, with the one which served to discover the planet. These little specks appear still nebulous with that instrument; and one perceives only a feeble and obscure glimmering. But the telescope of twenty feet permits one no longer to doubt that they are clusters of stars, which
appear

appear confused only from their immense distance ; by this telescope they are found to be perfectly distinct.

Mr. Herschel requested me to direct my principal attention to the stars which he was the first to discover to be of different colours from each other, and among which some are seen that border on blue, others on orange, and several on a bluish colour, &c.

It is certainly neither to an optical illusion, nor to the effect of the mirrors and lenses, which Mr. Herschel uses, that we ought to attribute this difference of colour. I started every possible objection upon the subject ; but the learned observator always answered them by facts, to which it would be unreasonable to reply. Thus, for example, he repeatedly directed the telescope to two double stars of pretty nearly the same magnitude, and separated from each other by a small interval only ; that is, small in appearance, for the interval must be immense if we consider their distance from the earth. Both were of the same colour, and emitted the common white light of the stars.

On directing the same telescope immediately after to other double stars near them,

the one appeared to be evidently blue, and the other of a silver colour. The blue star was in some instances on the right, and in others on the left. I saw also some single stars of a blue appearance, several of a bluish white, and others of an orange colour.

Mr. Herschel said to me with much modesty, that this discovery was not of very great merit, since it was easy to make it without recurring to large telescopes; acromatic ones with large object-glasses being sufficient to discover the coloured stars above mentioned.

The observations, however, of Mr. Herschel were at first disputed, for it is much easier to deny than to examine. But they were soon confirmed, as they deserved to be, by the astronomers of Germany and Italy, and by M.M. Delassini, Mechain, &c. of the observatory of Paris.

Mr. Herschel shewed me a pretty large work on the stars; which he designs to publish as soon as it is brought to a conclusion. He has confirmed what has been long since observed, that several stars distinctly marked in the ancient catalogues, and of which some are even laid down in the celestial Atlas of Flamsted,

Flamsted, have entirely disappeared. It is thus probable, that there sometimes happen great revolutions and terrible catastrophes in several parts of the system of the universe; since, if the stars were suns, their extinction must have annihilated the organised beings who existed on the planets which they illuminated*.

Jupiter, viewed with the telescope of twenty feet, appears much larger than the full moon †. His parallel belts are very dis-

* " Sometimes," says Laplace in his *Exposition du Système du Monde*, tome i. page 88. " stars have been
" observed to appear on a sudden, and then to disappear,
" after shining for a while with the strongest lustre. Such
" was the famous star observed in 1572, in the constella-
" tion of Cassiopea. In a short time it surpassed the
" brightness of the most splendid stars, and even of Ju-
" piter itself. Its brightness then decreased, and sixteen
" months after its discovery it entirely disappeared, with-
" out changing its place in the heavens. Its colour un-
" derwent several considerable alterations; having been
" at first of a bright white, then of a reddish yellow, and
" last of all of a lead-coloured white."

† This is not astonishing, when we reflect that Jupiter is at least a thousand times bigger than the earth. " Ju-
" piter," says Laplace, " is at least five times farther
" from us than the sun. When its apparent diameter is
" 120 seconds, the diameter of the earth would not ap-
" pear, at the same distance, under more than an angle
" of 11 seconds. The bulk of Jupiter is therefore,
" at least, a thousand times greater than that of the
" earth." *Exposition du Système du Monde*, par Laplace,
tome i. page 78.

tinct,

ting, and his satellites are of a truly astonishing magnitude.

On directing the same telescope towards Saturn, we saw his ring in the most distinct manner, and also the shadow which it projected on the body of that immense and singular planet. Mr. Herschel shewed me the sky, and even several stars, in the interval between the moveable ring and the planet. By means of some luminous points which are remarked in the ring, he was enabled to discover that this solid circle has a rotation from west to east in the same manner with the other planets of our system.

The micrometer which Mr. Herschel uses is composed simply of two threads of silk, very fine, well stretched and parallel, which may be moved to a greater or shorter distance at pleasure. The instrument of parallel threads was known before, but this acute observer has perfected it, by finding an easy method of turning one thread over the other at pleasure; so that, on placing them in the telescope, he can take angles with the minutest precision.

The inventor of such large telescopes is far from having confined himself to those
of

of twenty feet long. He was engaged in making the necessary preparations, to construct one of forty feet in length, and of a proportionable diameter *.

Mr. Herschel's intention in constructing telescopes of this great size, is not so much to magnify the object, as to obtain, by the aid of mirrors of such a vast field, a more considerable quantity of light. This project is new and excellent. He told me, that he expected to encounter great difficulties in carrying to perfection a telescope of that dimension and weight; but that he, at the same time, expected such great effects from it, that nothing should be capable of discouraging his progress †.

I re-

* The mirror is four feet in diameter, and weighs two thousand weight: the telescope, with its apparatus, weighs forty thousand weight. "It gives so much light," says Lalande, who saw it when finished, "that the nebula of Orion seen through it, emits a brightness like that of noon day." *Astron.* tome ii. p. 635, *nov. edit.*

† Since that period, this astonishing telescope has, with immense labour, been carried to the highest point of perfection. William Herschel himself, in a letter to M. Watson, dated the 10th of September, 1791, speaks of it as follows:—"I have, as usual, been much occupied in polishing mirrors, for telescopes, of all sizes, in order to bring to perfection that difficult part of optics. It would,

I remained until daylight in that astonishing observatory, constantly occupied in travelling in the heavens, with a guide, whose boundless complaisance was never wearied by my ignorance, and the importunity of

“ would, truly, be impossible to conceive the time which
 “ I have spent, and the pains which I have taken, to ac-
 “ complish this end. But I have been amply compensated
 “ by the pleasure which always accompanies the pursuit of
 “ a favourite object, and by the success which I flatter
 “ myself I have obtained. My telescope of forty feet is
 “ actually the best instrument I have in my possession;
 “ that is to say, it enables me to observe better than any of
 “ my other telescopes, those objects which are most diffi-
 “ cult to be seen distinctly, such as Saturn, his satellites,
 “ and his ring, or rather his rings; for I have lately trans-
 “ mitted to our president a paper relative to that planet,
 “ in which I have clearly shewn that it has two distinct
 “ rings, separated from each other by a considerable dis-
 “ tance—such, that with my telescope of forty feet, I have
 “ seen the sky very distinctly through this space, the ex-
 “ tent of which is 1741 of our miles: the diameter of the
 “ exterior ring, measured with the same instrument, ap-
 “ pears to me more than 222 of our miles. I have also
 “ proved, in the same paper, that the fifth satellite of Saturn
 “ turns round its axis in 79 days, 7 hours, and 47 mi-
 “ nutes; a time equal to that of its revolution round
 “ the planet: thus its movement, in this respect, exactly
 “ resembles that of the moon, whose revolution on her
 “ axis is made precisely in the same time she takes to pass
 “ round the earth.” *Journal of Experimental Philosophy*
and Natural History, 1792. It ought not to be omitted,
 that Mr. Herschel has discovered two new satellites belong-
 ing to Saturn, with the same telescope.

my

my questions. I passed about seven hours there, employed without intermission in observing the stars. It was impossible to think the time long, when spent in an employment of so profitable, and, with respect to me, curious, information. That delightful night appeared no more than a dream to me, and seemed to last only a few instants; but the remembrance of it is indelible; and the grateful recollection of the kindness with which Mr. Herschel, and his interesting sister, condescended to receive me, will never be erased from my heart.

I left *Slough* (the name of the place where Mr. Herschel resides) about eight in the morning, to go to Kew; where Sir Joseph Banks had appointed me to meet him, for the purpose of shewing me the whole of the superb gardens of that place, particularly that of botany.

GARDENS OF KEW.

This charming place is seven miles from London. I shall not enter into a description of the house, the pleasure-gardens, the temples, the bridges, or of the towers, which decorate them; I shall confine myself to
what

what relates to the garden for botanical instruction. George III. has been careful to assemble there the rarest vegetable productions from all parts of the globe. By this he has rendered a signal service to botany, as he has performed a no less important one to astronomy, by so honourably encouraging the labours of Herschel, and enabling him to construct the largest and most perfect telescopes which mankind have ever yet witnessed.

The gardens of Kew are so well laid out, and so well kept, the order and the taste which they exhibit are so admirable, and art has here so studiously endeavoured to resemble all that is beautiful and striking in nature, that I give them the preference to any thing of the kind that I have ever seen.

The weather was delightful, and the season had been so favourable, that the rarest and most delicate vegetables displayed a luxuriance and variety of foliage, blossoms, fruits, and perfumes, which formed an enchanting whole.

What most attracted my admiration in this garden of exotic trees and plants, was an exquisite neatness, a pure taste, and a judicious

judicious order, which must there render instruction amiable. The mixing of the trees and shrubs of both hemispheres is so well conducted, and so perfectly harmonized, that the mind seems to rest every where with the same satisfaction: its sensations are soothing, but varied; every thing charms, and nothing fatigues it.

The green-houses are disposed with much judgment. Some of them have only a moderate heat, for the plants which thrive in a mild temperature; some receive a strong and parching heat, suited to those of the climate of Africa; and others, designed for plants found in parts of America, where the atmosphere is loaded with vapours, receive a humid heat. It is with all these precautions, and these imitations of nature, aided by incessant care, that plants the most precious, and the most difficult to preserve, grow here almost as well as in their native soil.

I saw, with considerable interest, in one of the green-houses, a curious plant, which had just come in flower; it was the *hedysarum girans*, brought from the East Indies, in 1775, by Doctor Patrick Ruffel.

This

This tall and elegantly-formed plant is endowed by nature with a sensibility so remarkable, that, if placed under glass frames, inaccessible to the air, about mid-day, when the sun is most powerful, its lateral leaves, which are formed in the shape of a spear, exhibit a spontaneous movement of ascent and descent, such as might lead one to imagine that their motion is the effect of art*.

Another species of the *hedisarum*, brought from Cochin China by Sir Joseph Banks, was likewise in blossom at the same time. Its leaves are of a form so extraordinary, and of a tint so fantastic, that it has received the name of the *bat hedisarum*; but the contour of the leaves, their lightness, and their colour, have a much nearer resemblance to the wing of a butterfly†.

Amidst a multitude of rare and singular plants, one of them attracted my particular

* *Hedisarum foliis ternatis ovali-lanceolatis, obtusis lateralibus imminutis.* Aiton, Hortus Kewensis. *Hedisarum girans.* Linn. supp. 332.

† *Hedisarum foliis simplicibus ternatisque; foliis intermediis bilobis; lobis lanceolatis divaricatis, leguminibus plicatis.* Aiton, Hortus Kewensis. *Hedisarum vespertilionis.* Linn. supp. 331. *Bat-winged hedisarum, nat. of Cochin China. Introd. 1780, by Sir Joseph Banks: fl. July and August.*

attention :

attention : it was the *dionea muscipula*. I had seen it once before in the botanical garden of Paris. Franklin has caused it to be sent over in its native state from the marshes of South Carolina as a present to Bouffon. It arrived in good condition ; but it was so delicate, that it lived only six months. In the garden of Kew, however, this plant was in the best possible state of vegetation *.

This extraordinary plant has thick leaves, like those of certain oily plants. They are disposed in the form of hinges, covered with prickles, and furnished by nature with a honied substance. The flies, attracted by the sweetness of the liquor, come to feast themselves upon it ; but the plant is endowed with such acute sensibility, that it is irritated by the smallest touch ; the leaf doubles up its folds, shuts upon itself, seizes the insect with its prickles, pierces and kills it. Nature thus appears as inexhaustible in her means of destruction, as in her means of creation.

* *Dionea muscipula*, cal. 5 phyllus. Petala 5, cap. f. unilocularis, gibba polysperma. Aiton Hortus Kewensis. *Dionea*, Linn. Mant. 238. Venuig. fly-trap. Nativ. of Carolina, fl. July and August.

The *magnolia grandiflora*, planted on a rising ground, and forming trees of a great height, were covered over with their beautiful flowers, which perfumed the air. Their foliage of a bright green above, and of a pale yellow and variegated colour below, produced a very striking effect; they were contrasted with trees of a silver-coloured, and others of a reddish, foliage.

Evergreens, resinous trees of all kinds, loaded with their scaly fruit, and of various shapes, were seen in conjunction with those of a soft green, with umbrageous trees, with some of downy, some of indented, and others of palmated, leaves. From these various intermixtures, combined with art, and arranged with taste, there resulted a variety of forms, attitudes, and colours, which produced the most striking contrasts, without ever exhibiting an injudicious contrariety.

The polypodes, ferns, and different plants which require coolness and the shade, are placed in appropriate situations. The heaths, honeysuckles, brooms of various kinds, ivies, and myrtles, appear in their vicinity.

But nothing astonished me so much as
the

the admirable art, by which mosses, the most delicate capillary herbs, and even some *lichens*, have been raised with such success, as to unite in one place the most complete and the best assorted display of the richest vegetable productions of nature.

To accomplish this purpose, there was collected a great quantity of lavas, of which Sir Joseph Banks had brought a plentiful supply on his return from Iceland, where he had gone to visit the volcano of Mount Hecla. The ballast of his vessel consisted entirely of its lavas; and it was this circumstance that suggested the fortunate application that has been made of them. As these lavas are full of cavities, fissures, and wrinkles, spongy, and capable of imbibing and long retaining water, it was resolved to form thick borders of them more or less elevated, round the verges of a shady piece of ground, appropriated to this moss-garden, which is the only one of its kind in the world.

This numerous family of *cryptogames*, so varied in form and colour by their mysterious and wonderful fructification, grow up and thrive in the cavities of these little artificial rocks in a manner which appears almost

miraculous, and which does honour to him who first conceived that happy design.

The experiment having perfectly succeeded, they wished to practise it on a greater scale. To effect this, the lavas imported from Iceland being exhausted, they had recourse to factitious lavas, which were formed of lumps of clay, vitrified in a violent fire of pit-coals, and which were found to answer nearly the same purpose.

It must be allowed, that the climate of England, which is very favourable to the growth of those plants, contributes much to the success of this pleasing invention. I am of opinion, however, that similar attempts may be successfully made in other places, and that the grand botanical gardens may thus be enriched with an assemblage of objects, which cannot, in general, be studied but in herbals, or by performing voyages, which one is not always in circumstances to undertake.

Mr. William Aiton, who is the manager of this magnificent garden, and who has contributed to bring it to its present state of perfection, is occupied in writing a description of its numerous and rare plants, which he

he has cultivated with so much knowledge, zeal, and application. This work is expected with impatience, and will be received with interest by botanists, and by all those who know how to estimate the talents of Mr. Aiton.

This modest naturalist exerted himself in the most affable manner, as did also Sir Joseph Banks, to point out and explain every thing that could interest my curiosity. I felt the more indebted to their extreme complaisance, as my ignorance obliged me to trouble them repeatedly with importunate questions; and I gladly seized this opportunity to renew my apology, and my thankful acknowledgments*.

BRITISH MUSEUM.

This immense collection of scientific and curious objects is deposited in the vast house

* Mr. Aiton published, in 1789, an excellent work, containing a description of the plants of this garden, under the title of *Hortus Kewensis, or, a Catalogue of the Plants cultivated in the Royal Botanic Garden at Kew. By William Aiton, 3 vols. in 8vo. fig. London, 1789.* A short time after the publishing of this book, death deprived his friends and botany of this estimable naturalist. His son succeeded him in the management of Kew gardens.

of the late Duke of Montague in Great Russell-street.

This museum is composed of manuscript and printed books ; of Egyptian, Etruscan, Greek and Roman antiquities ; Indian, Chinese, and Japanese idols ; of the vestments, weapons, and utensils of the islanders of the South Seas and other savage nations ; of quadrupeds, amphibious animals, birds, insects, fishes, shells, and other marine productions ; of minerals, petrifications, and fossils of every kind.

This immense assemblage of objects was partly formed by the celebrated Hans Sloane. It is a pity that the collection was not allowed to remain as he originally left it. Had no additions been made to it, and had it been allowed to retain the modest title of *Sloane's Museum*, many would doubtless have been anxious to visit the collection of that indefatigable naturalist, and would have viewed with as much astonishment as satisfaction, what the love of science, aided by an affluent fortune and liberal disposition, had been able to perform.

But I am not pleased that the collection of a private individual, to which there has been

been since superadded a crowd of heterogeneous objects, calculated rather to distract, than to command the attention, should possess the title of *The British Museum*.

A nation, respectable from the highly perfect state of her commerce and manufactures, and the importance of her navy, the results of a multitude of difficult combinations and profound knowledge, ought to have monuments worthy of herself, and more analogous to the grandeur and stateliness of her character.

The English have been reproached with not giving sufficient encouragement to the sciences, and especially with not investing them with the consideration which they merit. I cannot, I must confess, decide upon that charge. But if it were well founded, the government should seem very little attentive to that in which it is most deeply interested; for those who sit at the helm of affairs are by far too enlightened to be ignorant that England has reaped more real glory and distinction from the uncommon geniuses which she has produced, than from her conquests in both the Indies, her fleets,

her battles, or her eternal parliamentary discussions.

All her political superstructure, notwithstanding its utility, will a thousand times disappear, whilst the name of the immortal Newton *, that of Napier †, of Halley ‡, of Bradley ||, and other illustrious philosophers, will be held in veneration by all nations among whom war and the homicidal

* The glory of the English nation.—An immortal genius, who claims pre-eminence over all others, from his discovery of the principles of the celestial movements, and the laws of universal gravitation. His Principia is the greatest and most astonishing work ever produced by the human mind.

† Napier, a Scotch Baron, who was the inventor of Logarithms, an admirable contrivance, “ which,” says Laplace, very justly, “ by reducing the labour of many “ months to that of a few hours, has in a manner doubled “ the lives of astronomers, and saved them from the errors and disgust inseparable from long calculations;— “ an invention so much the more satisfactory for the human mind, that it has derived it wholly from its own “ source. In the arts, man employs the materials and “ the powers of nature to increase his own powers; but “ here every thing is his own production.

‡ Halley, whose profound investigation of the Cometary System enabled him to discover and to predict the return of the comet which appeared in 1769.

|| An astronomer, for ever celebrated by his discovery of the aberration of the fixed stars, and the nutation of the earth's axis.

fury

fury of conquest shall not have extinguished the torch of intellect and knowledge, which enlightens the path of truth, the sole object of man in the rapid career of life.

The British Museum contains many valuable collections in natural history; but, with the exception of some fishes in a small apartment, which are begun to be classed, nothing is in order, every thing is out of its place; and this assemblage appears rather an immense magazine, in which things have been thrown at random, than a scientific collection, destined to instruct and honour a great nation.

It may be presumed, that as long as this disgusting confusion is suffered to continue, no artist will ever be excited to go there, to acquire those branches of information which relate to the materials he uses, and the sources whence they are derived.

Never will the painter repair thither to see and to study animals according to nature, and to admire the different modes of colouring, and the infinite variety of shades presented by the plumage of birds, the gay attire of butterflies, and the oriental splendor of shells.

Never will the physician, who devotes his
studies

studies to the curing, or alleviating the diseases of his fellow-creatures, go to learn from that chaos the means of distinguishing with precision the beneficent productions, which in the various climates of the globe nature seems to offer to man, in order that he may mitigate or remove those evils with which he is every where assailed.

Neither will the philosopher, who loves to behold nature on a great scale, nor he who delights in studying the details of that immense chain which seems to connect every species of being, and to unite its last link to the first, find any thing to interest them in the midst of such disorder.

In a word, youth, so inquisitive, and so fond of novelty, will here find no excitement to study, from that attractive lure, which captivates by the elegance and correctness of arrangement, and which is so well calculated to create or unfold a taste for the history of nature.

But that arrangement, which has no existence at present, may one day be accomplished. I sincerely wish it for the progress of natural science; a nation, whose political and commercial relations extend to both hemispheres,

mispheres, and whose ships traverse so many seas, may, whenever she pleases, easily form an assemblage of the most splendid and richest productions of nature. The National Museum of Natural History at Paris, which is so justly esteemed superior to every collection of the kind, would not then be the only cabinet worthy of admiration; and thus a national rivalry, much more honourable than that which arises from cabinet intrigue or vulgar prejudice, would contribute to the enlargement of human knowledge, and thereby to the happiness of the whole human race.

CHAPTER III.

Arts and Manufactures.—Philosophical and Mathematical Instruments.

IN England, the makers of instruments used in the sciences enjoy merited consideration. They are, in general, men of great information; and spare neither time nor expence to carry their workmanship to the highest degree of perfection. The demands of the navy, and the great number of persons whose wealth enables them to pay well for the best-constructed instruments, are among the causes which have concurred to form artists of high reputation, and who have served as instructors to others. I gladly embraced the opportunity of visiting several of them, under the auspices of Messrs. Whitehurst and Cavallo.

I found the skilful and modest Ramsden occupied in making an instrument simple in appearance, but which demanded much care and many combinations to render it perfect.

It

It was required to measure on the ground a base of four thousand two hundred and eighty-six toises, so as to avoid the defects of the ordinary instruments of measuring; which, whether of wood or metal, are liable to be expanded by heat and contracted by cold, and to several other inconveniencies, that do not permit one to depend on their perfect accuracy, whatever precautions may be taken in using them.

To effect this purpose, it was proposed to use rods made entirely of glass; and it was in preparing these that Ramsden was then employed. The glass tubes were executed with all possible care, in the glass manufactory of Parker, to the best of my recollection. They were all of the same diameter, and straight as the most perfect ruler.

They were very long, and fixed on proper supports, with a water level to each; they could be elevated or depressed horizontally at pleasure. As these rods were to be used by placing them end to end, to ascertain the point of contact with greater precision, the extremities of each were carefully cut and ground down with emery; and on being disposed in the requisite order, they were gradually

dually brought to touch each other by means of a vice. By this method great bases were obtained with a precision of measurement, of which there had formerly been no example*.

I had much pleasure in conversing with Ramsden. I went to see him several times; and I purchased several instruments at his shop. He possesses all the modesty and simplicity of manners of a man of great talents.

There are also in London other able artists employed in making the larger instruments of astronomy, mathematics, and experimental philosophy;—such as Messrs. Bird, Dolland, Adams, Nairne, Blund, Hunter, &c.

It contains likewise many clock and watch-makers who excel in their art.

MANUFACTURES.

WEDGEWOOD.

The black pottery, known under the name of *basaltes*, which has the colour, the

* See, upon this subject, *Lalande's Astronomy*, tome iii. page 15, of the thirteenth edition, 1792; see also *Philosophical Transactions*, 1765, page 385, by General Roy and Mr. D'Alby.

hardness

hardness, and the opacity, of the volcanic stone of that name, and its application by Mr. Wedgewood, to busts, basso-relievos, and vases of the finest antique forms, do honour to the taste and ability of that celebrated manufacturer.

With other materials he has successfully imitated the Etruscan vases, of which England possesses a very rich collection, owing to the exertions of Sir William Hamilton, who procured them during his embassy at Naples, and to the liberality of parliament which purchased them, with the view of facilitating for the English artists the study of the most excellent models.

Wedgewood has infinitely varied the art of preparing and combining the several earths, so as to form them into the most beautiful productions. He well knew that porcelains have been brought to the highest perfection in France, and that nothing can surpass those of Sèvres, and some other manufactories, which have branched out from it; he therefore chose a different course, and, disdaining to be a mere copyist, he has, in a manner, created a kind of pottery peculiar
to

to himself, and which might be regarded as absolutely original, if the vessels which come from China, of red and brown earths, without semi-transparency, and of great hardness, had not served him as models. He has, nevertheless, the merit of having excelled the Chinese, by discovering new compositions, and more especially by adopting the most elegant shapes.

As his pottery is used in every part of Europe, and as example is more efficacious than any theory, or the best written instructions, it is evident that Wedgewood has contributed to a sort of revolution in the art, by multiplying agreeable forms, and accustoming the eye to enjoy their graceful proportions.

This able artist having daily occasion to study the action and different modifications of fire, acquired the power, in a manner, of taking that element captive, and directing it at pleasure. The course of his inquiries led him to invent an instrument for ascertaining various degrees of heat, which bears his name, and does honour to his genius. The *pyrometer of Wedgewood* has a distinguished place

place in all the laboratories of chymistry and experimental philosophy*.

But that which has greatly increased the fortune of Wedgewood, and procured an immense branch of commerce to England, is his common pottery, known in France by the name of English-ware, and at London by that of queens'-ware.

Its excellent workmanship, its solidity, the advantage which it possesses of sustaining the action of fire, its fine glaze impenetrable to acids, the beauty and convenience of its form, and the cheapness of its price, have given rise to a commerce so active and so universal, that in travelling from Paris to Petersburg, from Amsterdam to the farthest part of Sweden, and from Dunkirk to the extremity of the south of France, one is served at every inn upon English-ware. Spain, Portugal, and Italy are supplied with it; and vessels are loaded with it for the

* The celebrated Spallanzani has very successfully applied it to determine the degree of fire necessary to fuse the lavas in volcanos; he found, that a less degree of heat than that of ordinary glass-houses was sufficient for the purpose. See, upon this subject, vol. I. of Travels in the Two Sicilies, by Spallanzani.

East-Indies, the West-Indies, and the continent of America.

This universal taste, this invariable desire to procure that ware, is a sufficient demonstration that, from its solidity, form, and cheapness, it is perfectly agreeable to those who make use of it. In this point of view, Wedgewood has made an excellent discovery, and has deserved well of his country, since he has given existence to an extensive branch of industry and commerce*.

PARKER'S

* France possesses all the materials requisite to imitate to perfection the English stone-ware, such as white clays, siliceous earths, minium, &c. A manufactory, established some years ago at Montereau, produces potteries, which are not, it is true, equal to those of England, but which, with some assistance and management, particularly that of employing pit-coal, would reach a higher degree of improvement.

Some very respectable citizens of Geneva, who commenced their labours with more intelligence and greater means, accomplished their object after repeated experiments. They made several journies to Paris, to solicit the transporting of their establishment in France into the department of Here, to be nearer the kinds of earth which they employ, but scarcely were they attended to. I know not whether justice has been since done to their requests, or whether, weary of soliciting, they have at last renounced a project so useful for France; but this I well know, that upon every occasion where the arts are strangers to those who administer the finances of a great nation, it is deprived

of

PARKER'S MANUFACTORY OF FINE GLASS.

Those who love the arts ought not to neglect to visit the warehouses and glass-manufactory of Parker.

of its resources, and compelled to have recourse to the industry of its neighbours.

It is from this conviction, that the government thought they did well in prohibiting the importation of English manufactures; but every thing manufactured by them, of a superior quality, and at a cheaper rate than among us, will be imported notwithstanding, and will only become dearer than formerly. The English, who would, no doubt, wish to retaliate, will not be so ill-advised, as to prohibit the entry of our wine, which they cannot well do without. They have always subjected it to heavy duties of importation; the rich consumers pay them, and the state becomes a gainer.

I heard a man, who is well versed in this matter, say, that it were a thousand times better to permit the traffic of English merchandise, to impose taxes on it, and then to apply one-fourth of the produce, by a wise distribution, to the encouragement of French manufactures; we should, by this means, soon have as good commodities as the English. It is by such encouragement that we have been able to imitate their fine glass works; it is thus that, owing to the intelligence and attention of the minister Benzezech, we have at Versailles a manufactory of fire-arms, of a finer finish and more exquisite workmanship, and also at a much cheaper price, than any made in London. Olivier, who has erected a very handsome manufactory in the street La Raquette, suburb Saint Antoine, has pretty well imitated the best productions of Wedgewood. It is unfortunate, that the state of the finances has not admitted of giving this valuable artist that encouragement which he has well merited.

There they will see to what varied extent that substance, pure as the clearest spring water, and more delightful to the eye than crystal, may be fashioned, in the hands of skilful artists, into cups, vases, basons, and bottles of every form.

They will be astonished at the dexterity and quickness with which the workmen cut, engrave, and polish into the purest brilliancy, those articles which contribute to the purposes of luxury and ornament, the various vessels which cover and decorate our tables, and the beautiful lustres which illuminate them, and reflect the splendid colours of the prism in a thousand directions.

Parker, like all those who are at the head of great manufactories in England, has made acquirements in more than one branch of knowledge; he has constructed a burning lens of a large size, and of remarkable effect: it is considered as the best of the kind ever made.

I had fixed a day with his friend, Mr. Whitehurst, to be present at some experiments to be made with it; but, as often happens in London, the sun was not visible: it was not in my power, therefore, to judge personally

personally of the effects of this large burning-glass*.

A LARGE BREWERY.

It is by facts, more than by any other means, that an exact idea may be formed of what industry is capable of effecting among a people, active and animated with the genius of commerce.

A large brewery, which I visited, on the south side of Blackfriar's-bridge, excited alike my astonishment and admiration.

The buildings and yards, which are of a vast extent, have no other object than utility; every thing is solid, every thing is adapted to its purpose, but every thing is an absolute stranger to ostentation.

Seventy large horses are employed in the

* The English glass works have been imitated in France: the first attempts were made, with success, in the park of Saint Cloud, at the instigation and under the auspices of Marie Antoinette, who loved and encouraged the elegant arts. That manufactory was transported to Creuzot, near Mount Cennis, in Burgundy, where it received the name of the queen's manufactory, on account of her having contributed to establish it. It is formed on the most extensive scale; very excellent glass works are made there; and it has already given rise to similar manufactories at Paris, and other places.

service of this brewery. Of a hundred workmen, unceasingly in motion, some prepare the malt and the hops, or are employed about the fires, the coppers, or the coolers; some rack off the beer, and others convey it into large vats, which I shall presently describe.

The beer is fermented in vast square vessels, raised to the height of the first floor; and pumps, disposed with much art, facilitate the supply of water.

When the beer is made, it descends through pipes, and is distributed, by means of funnels, into a number of casks, placed in an immense cellar. The beer becomes of a more perfect quality in those casks, where it remains, however, but a short time; from them it is drawn off by long spouts, and transfused into a great reservoir, whence it is again raised, by pumps, into vats of an astonishing magnitude, which are placed vertically, and the top of which cannot be reached without a ladder: a gallery goes round the places which contain these vats.

Four apartments, situated on the ground-floor, and of different dimensions, are appropriated to receive them.

In the first, which is the smallest, there are six vats, containing each three hundred hogheads; a hoghead contains about two hundred and forty bottles; in the second, there are twenty-eight vats, of four hundred hogheads; in the third, fourteen of nine hundred hogheads; and in the fourth, four of five hundred hogheads each.

Thus the whole of them is capable of containing thirty-one thousand six hundred hogheads.

The ordinary quantity sold, one year with another, is about a hundred and forty thousand hogheads. During the last war it was much more considerable, the proprietor of the brewery having had a contract for supplying the navy. One may form an estimate of the sale at that period, from the duties yielded by the beer then made. I was assured, that they amounted to ten thousand pounds sterling a month.

It was not very long since this brewery had been sold, on the death of the former proprietor; it was put to auction, and knocked down at the price of three millions two hundred and eighty-eight French livres.

It is remarkable that twenty-two bidders

contended for it, though it was necessary, not only to pay down that sum, but to be able to advance as much more as would be requisite to set so vast an establishment in motion.

It is, perhaps, superfluous to observe, that almost all the beer brewed in this extensive work, is of the kind called *porter*, which is of a strong body, capable of sustaining long sea voyages, and of being preserved in bottles for many years: it is, indeed, necessary, in order to have it of a good quality, that it should remain several months in the large vats.

These vats, made of wood of the choicest quality, are constructed with an admirable solidity, justness, and precision, and also with an appearance of elegance: some of them have as many as eighteen hoops of iron; and several were pointed out to me, which had cost ten thousand French livres a-piece.

I have already said, that they were all placed on end around the walls; but, on asking what they stood upon, my conductor shewed me, that they rested on brick arches of great solidity, and strengthened by a number of thick upright pillars of wood. Their
bottom

bottom was thus protected from the humidity of the ground, and it was more easily seen whether the beer escaped through them.

The top of the vat was carefully covered with thick planks, joined together in the most perfect manner, and these again were covered with fine sand, six inches deep.

At a small distance from this brewery, there is another for making malt-vinegar, fitted up in the same manner; but, in the latter, the vats stand in the open air, and occupy an immense yard. Their height and capacity are such, that on entering the vast inclosure filled with these gigantic vessels, ranged in different lines, one is apt to imagine, by an illusion proceeding from the want of exact comparison, that one sees a succession of ships of the line, lying by the side of each other in a harbour.

The vinegar made from strong beer, of a good quality, is better than one would expect; there is no other kind used in any part of England, the importation of vinegar, made from wine, being severely prohibited.

MANUFACTORY OF TURKEY-LEATHER, OF
PARCHMENT, AND SHAMOIS LEATHER.

I am pleased with seeing manufactures of every kind ; they provide for our wants and conveniencies, and supply us with the materials of luxury. These productions of industry are owing to the united efforts of men : they have contributed more than is generally believed to the development of the human faculties ; and before they arrived at that pitch of perfection which they have attained among some nations, the arts must have passed through a thousand essays, and have groped their way through a thousand obscurities, which announced that their progress is the same with that of the human mind, which proceeds by small steps, and journeys but slowly in the path of discovery.

I like also to see the manner in which different nations exercise the same art ; there are always particular processes used in one country which are not practised in another.

We are acquainted with the cause of the excellent quality of the leather made by the English ; it is principally owing to the pecuniary advances which they are in a condition to make, so as to permit the hides to remain longer

longer in the pits, and to some improvements in the workmanship.

At Annonai and Grenoble, skins for white gloves are manufactured, which surpass those of England. But in England, they have for a long time had the art of making parchment, vellum, and particularly Turkey-leathers, of a quality superior to ours.

It may, indeed, be said, that the manufacture of Turkey-leather is still in its infancy in France, though it existed there in considerable perfection formerly, if we may believe a celebrated author *. But the civil wars, particularly those of religion, put to flight our finest manufactures, which were allured into Germany and England by toleration, the liberty of worship, and sound policy.

I had a conversation upon this subject with a very intelligent Englishman, who proposed to conduct me to a manufactory of this article, situated in one of the extremities of London, and directed by persons of the name of Lorraine. I was told that I should there see a press of very great force, the effect of

* Rabelais mentions the fine Turkey-leather of Montelimar in Dauphiny.

which

which was to perfect the quality of the skins to be prepared into Turkey-leather.

I went to visit this excellent establishment, where every thing is conducted with an intelligence and method which much interested me. But in the operations which they were pleased to permit me to see, I did not observe any thing which I had not seen practised in other places. It is not improbable, indeed, that they concealed some parts of the process from me, for they did not always reply to my questions; nor could I much disapprove of their silence. The great press, however, which is not shewn to every body, was set in motion before me, and I was made acquainted with all its details.

It is made of iron, and weighs twenty-two thousand pounds. It does not differ from ordinary presses in any other respect than being of a greater size, and having all its parts more perfectly finished. It is usually worked by four men, and produces a very powerful pressure; but when it is required to employ the highest degree of force, two horses are yoked to it.

Skins of different kinds, which in ordinary manufactories would have been thought sufficiently

ficiently dressed (that is, which were well pressed, and discovered no remains of the unctuous substances used in preparing them), were wetted and put into the press.

The water which oozed from it was collected, and during the last strokes of the press a thick oil swam on the top. This oily matter, said the manager, in time becomes rancid, and acquires an acid quality, which not only alters the colours of the skins, and gives them a blackish appearance, but also corrodes their grain, and the reticulated substance which gives them consistence; they are thence of little durability. This observation appears just, and deserves to be taken into consideration by those who are engaged in this business.

As the manufactory is considerable, a good deal of oily matter, which would otherwise be left, is obtained by this mode, and made into tallow.

CHAPTER IV.

Monument of the Fire of London.—Quakers.—Some Cabinets of Natural History.—Sir Henry Inglefield.—Preparations for our Journey to Scotland, and the Isle of Staffa.

THE stairs of the column called the Monument were receiving repairs, which gave me a better opportunity to ascend it, and to view from the summit the city of London and its environs.

This column, which is situated at a short distance from London-bridge, is of the Doric order, and two hundred and two feet in height, and fifteen feet in diameter. It was erected by the city in memory of the famous fire of 1666; and is considered as one of the master-pieces of Sir Christopher Wren.

The monument having been already described by a number of travellers, I should not have mentioned it here, were it not for a particular circumstance which my visit to it gave me an opportunity of remarking.

I had

I had begun to ascend the three hundred and eighty steps leading to the upper balcony, when I perceived that the inner rail which winds round with the staircase was decayed and unserviceable. The higher I ascended the deeper was it decayed; and having reached the platform, I observed that the balustrade which went round it, though made of iron of a considerable thickness, was almost entirely destroyed, particularly in the direction of certain currents of air; so as to render it dangerous to approach very near it.

I conceived, indeed, that the vicinity of the sea must occasion acid vapours, injurious to all the metals, but especially to iron. I observed also, that the numerous balustrades which inclose a great number of the houses of London, required frequent painting to preserve them. But I should never have imagined that the decay could have been so rapid, in so short a space of time, supposing even that the railing of the monument had never been repaired since its foundation, that is, since the year 1666.

In several towns of the north and south of France, much nigher the sea than London, I have seen vanes of steeples, balustrades of balconies,

balconies, and iron ringbolts for fastening vessels to, of more than two hundred years old, which had not sustained one-fourth part of the damage of the iron-work of the Monument of London.

It is thence to be inferred, that the atmosphere of this city is impregnated with corrosive emanations more copious and active than elsewhere; and this might, indeed, be expected, where there is so great an assemblage of inhabitants, who use nothing, for common firing, throughout the whole year, but pit-coal, and in a city filled with manufactories and establishments of every kind, which consume so many currents of air, and such enormous masses of combustibles.

I am very far, however, from thinking that the city of London is more unhealthy than other cities, because it has no other firing than pit-coal. For not only do experience and a long train of observations prove the contrary, but it is also to be presumed that this immense quantity of firing contributes to its salubrity; in the first place, by the strong, equal, and constant heat produced by the pit-coal, in an atmosphere naturally impregnated with water; and in the
second

second place, because so many chimnies, so many manufactories and works of every kind using fire, occasion currents and changes of the air on every side, which carry off the noxious and pestilential vapours that always take place when the respirable mass is too long stagnant.

With regard to the emanations from the coal while it is burning, they are of two kinds: the first are bituminous, and even a little balsamic, and, therefore, rather salutary than injurious to the lungs. The second, which are disengaged when the combustible is very strongly burnt, are acid, and consequently antiseptic. But the good construction of the chimnies, and the impulsive action of the fire, elevates the column of vapours above the habitations. Then the smallest wind (and there always blows one at a certain height) removes and dissipates these emanations, which act only on the iron works, particularly the most elevated, or on the foliage of trees planted too near the city.

Besides, the incalculable advantages yielded by the pit-coal, that useful combustible, on which the existence of England in a

manner depends, are amply capable of compensating the few slight inconveniencies which attend the using of it : and though it should put our fashionables of Paris, like those of London, to the trouble of changing their linen twice a-day, I should wish, for the happiness of individuals, and the general prosperity of my country, that France were as far advanced as England in the general use of pit-coal.

Let not those who have only vague notions of the subject, say that we have neither so much nor so good pit-coal as is found at Edinburgh, Glasgow, and Newcastle. To convince them of their error, I would only appeal to the opinion of several intelligent Englishmen who have travelled with advantage in France. I speak of philanthropic Englishmen, such as Arthur Young, Symonds, Sir W. Hamilton, Lord Greville, and others ; for, with respect to the British government, its policy obviously requires, that we should long continue ignorant on a point of so much importance, and which so closely interests our manufactures and our commerce. I shall resume the consideration of this useful subject,

ject, which I quit with regret, when I shall have visited the mines of Newcastle.

THE QUAKERS.

I love the quakers, and I am highly pleased with them in private, in society, and in their religious assemblies. They inspire me with a sentiment of involuntary veneration.

Cloathed with all that is most simple, plain, and modest, but at the same time, most neat, finished, and perfect; it appeared to me that their mind participated in the clear whiteness of their elegant linen, and that they were kept as pure, and as void of blemish, as their vestments.

Buffon had just reason to say, that men become, in a manner, identified with their attire, and that it is of much more importance than one imagines, to accustom youth to attend to what is called genteel and decent appearance. There is much profound sense in what that illustrious man wrote upon this subject. He said also "When we
" form our opinion of a man, we attend to
" his physiognomy; there is nothing about
" him, even to his clothes and head-dress,
" which

“ which has not some influence on our
 “ judgment. A sensible man should re-
 “ gard his vestments as forming part of
 “ himself, since they are such, in fact, in
 “ the eyes of others, and since they oc-
 “ cupy some place in the general opinion
 “ which one forms of the person who wears
 “ them *.” *Histoire Naturelle de l’Homme*,
 page 520, in 4to.

The

* A man who was not destitute of talents, but who wished at all risks to act a conspicuous part at a very early period, I mean Herault de Sechelles, made an excursion to Montbart, in 1785, to see Buffon, who kept him several days at his house, and was pleased to shew him marks of affability, and even of confidence.

In gratitude for so many testimonies of kindness, Herault, on his return to Paris, made the greatest haste to announce that he had filled his journal with anecdotes and curious details, respecting the great man whom he had been to visit; and he read in more than one circle, with a tone of mystery, this journal, written under the roof of hospitality. This composition, loaded with the minutest details, is an heterogeneous mixture of pompous eulogies, critical remarks, and satyrical episodes, often scandalous and almost always false. This species of domestic *espionnage*, which so strongly favours of ingratitude and depraved manners, would, in other times, have driven that man out of every society that had any respect for itself.

Herault appears to have wished to throw ridicule on Buffon on account of his hair, bleached with the labours of sixty years, of which he was very careful. He has affected

The places where the quakers assemble for worship, or rather to meditate, to descend into their own thoughts, and to await the inspirations of virtue in their hearts, are calculated to excite respect.

This kind of temples, like those of the people of antiquity, admits the light at the top of the roof only. The walls are of a dazzling white; the wainscoting, unincumbered with sculpture, shines in the modest lustre of its native colours, and the exquisite cleanliness with which it is kept; the seats are simple benches, placed in parallel rows. In vain would one look here for paintings, statues, altars, priests, and acolythists. All these accessories are considered by the quakers as superfluities, de-

affected to say, that Buffon caused it be dressed three times every day in five rows of floating ringlets.

The following is a fact upon this subject, which contains some more truth, and of which I was a witness. Madame de Nanteuil, a woman of great vivacity and beauty, came one day to see Buffon at Paris, about eight in the morning, on some business. He was at his toilette; she apologized for appearing in dishabille before the historian of nature.—

“What,” replied Buffon, “are you not already sufficiently decorated with youth and beauty. It is at my time of life that one ought to pay attention to dress, in order to conceal a little the deformities of age.”

vised by human invention, and as foreign to the Supreme Being. They prefer to offer up to him pure hearts, and acts of virtue and beneficence. They are persuaded that nothing can be more agreeable to him than that mild philanthropy which induces them to regard all mankind as brothers and real friends, with whom they travel, in common, the short, but difficult, road of life, in which they reciprocally stand in need of assistance.

They, accordingly, hold in abhorrence those cruel and sanguinary persons, who, from motives of ambition or vengeance, provoke war; that is, who compel or excite men who have no real cause of quarrel, to devour and assassinate each other in cold blood.

When the quakers are assembled in their churches, the men occupy a place apart from that of the women, and have their heads covered with a black hat, of a broad half-cocked brim, without loop or button. Their eyes are humbly bent on the ground, and often entirely shut, to avoid any interruption in the midst of their contemplative meditations.

The

The women also have their heads covered with bonnets, made of silk, velvet, or straw, but very plain. They, in general, conceal their faces; at least they do so in this place of self-recollection. Their hair is without powder, but is washed and trimmed with such neatness, that it forms one of their finest ornaments. They are attired in the most decent style; their clothes, however, are generally made of the finest and most costly stuffs, though at the same time of the gravest appearance.

At the farther end of the church there is a kind of estrade, a little elevated, and surrounded with a balustrade of wood. It does not resemble a preacher's pulpit; it has rather the appearance of a large and long rostrum, to harangue from. Here it is that those who are animated with celestial inspirations, take their place, to communicate in a loud voice to their brethren the transports of their souls, and the impressive sentiments which they have received from the Eternal.

I often beheld them, in that prophetic state, with a perfect conviction that they were no more inspired by the breathing of

the Holy Ghost, than were the Sybils in the time of the Oracles by the spirit of Apollo, or the Somnabulists, lately, by the illusions and signs of Mesmer.

But, making a distinction between the quakers, who are certainly sincere in their belief, and the latter, who exhibited nothing but imposture, I amused myself with tracing the impressions produced on them by the action of the mind, when too long employed in metaphysical abstractions. I saw some who often worked themselves into a state of giddiness with intense thinking, conceived that they were inspired, broke the profound silence which reigns in their assemblies, and mounted the rostrum.

Then it was that I was excited to view them more closely, by the aid of a glass. They keep their eyes half shut, or bent towards the ground, and slowly, and at long intervals, pronounce some expressions in a sad and melancholy tone; supporting themselves with their hands strongly pressed against the balustrade of the rostrum, and appearing to make efforts to call forth, and, as it were, to seize ideas.

They then swing themselves backwards
and

and forwards, and sometimes in a sidelong direction; at first with a motion slow and uniform, and accompanied by some words, delivered with a more rapid utterance. Their action soon redoubles: this struggle of body and mind impels the blood towards the head; the cheeks redden, ideas crowd upon the imagination, expressions follow; the whole soul and heart are kindled; a sort of quaking appears, and the orator is inspired*.

The women in similar circumstances discover pretty much the same appearances; they are neither more nor less loquacious. Many of these discourses are above mediocrity; several are tolerable, and it is said that some are even eloquent; but all of them are favourably received. The subject always turns on the duties of man, on the pardon of sin, and on lessons of the most perfect morality. I heard a female, one day, deliver a very excellent prayer to the Deity. She might possibly have prepared it beforehand; though it is not unlikely that her feeling soul inspired her ex-

* It is this which has procured them the name of *quakers*.

tempore with that fine emotion of love and gratitude. The female sex will always be able to give us lessons in this respect.

There sometimes happen meetings at which no person speaks. This might be expected among men of worth, who are happy in their own consciences, and more accustomed to put morality in practice, than to cry it up in words. As with them there are no discourses pronounced by a superior, or pastor, who governs his flock at pleasure, the only rule observed in that respect is, never to speak but from the impulse and transport of the heart. But as these depend upon an ardent mind, and a strong imagination, liable to be acted upon by physical causes, which must vary according to the season, the state of the air, or health, it follows that the thermometer of the head, no less sensible than that of art, must sometimes be found in a state of rest and stagnation.

But what seems to distinguish this simple worship from many others is, that experience has proved that it conducts men to the practice of their duties without fortifying them by vain superstitions; that it makes virtue amiable, by presenting her under attractive

tractive forms ; and that men of this class are valuable to a government, by the good examples which they exhibit. Happy in their acts of virtue, rich, in general, from their application to industry, they furnish the strongest proof that the morality of individuals, by creating private happiness, gives existence to public prosperity.

SOME CABINETS OF NATURAL HISTORY.

Mr. Drury's cabinet of insects must have been formed at a great expence, and it must have required much time, and many fortunate opportunities, to collect so many objects of this nature, brought from the East-Indies, from China, Japan, the South Sea, &c. Every thing is arranged, in this collection with much care and great neatness.

Smeathman, who had travelled in Africa, and who brought home several curious insects to Mr. Drury, with whom he was particularly acquainted, procured me admission to this cabinet. This recommendation was of so much use to me, that Mr. Drury had the complaisance to show me his collection in its minutest detail, and with much affability.

I knew

I knew, and was possessed of, his excellent work, entitled, *Natural History of Insects, classed according to their different Kinds, in English and French* (3 vols. in 4to. with coloured plates; 1770, and following years). I saw, therefore, with much interest, the insects which were delineated in this book.

I passed also some hours very agreeably in the cabinet of Mr. Thomas Sheldon, brother to the anatomist. It contains South-Sea shells, and other interesting marine productions.

I infinitely regret my not having seen the rich collection of Lord Greville, the relation of Sir William Hamilton, ambassador at Naples; but they had a little before set off together for Scotland, with the intention of visiting the Isle of Staffa.

I was also deprived of seeing the scientific collection of Lord Bute, as well as that of Dr. Pearson; neither of them being in London at the time.

Sir Henry Inglefield compensated these privations by the civilities and kindnesses which he heaped upon me, during my stay in that city. He has successfully applied himself to the study of astronomy and natural philosophy; he is an agreeable companion,

panion, full of affability and worth, and gives a hearty welcome to strangers. I sincerely wish to have the pleasure of seeing him in France, to repay with heartfelt gratitude the civilities I received from himself and his respectable mother.

If all Englishmen were endowed with such urbanity, it would be unjust to reproach them with that neglect and coldness which they are accused of showing towards those who have given them the best reception in France. This accusation, however, is exaggerated; and I have more than one proof that there are many exceptions to it.

As I intended to take advantage of the remainder of the good season, to perform my journey to Scotland and the Hebrides, I was busied for several days in making the necessary preparations for my departure.

Several learned characters were pleased to give me letters of recommendation to persons in Edinburgh and Glasgow, and to the Duke of Argyle, who was then in one of his estates in the north of Scotland, on the road which I had to take to the nearest point of embarkation for the Hebrides.

CHAPTER V.

*Departure for Scotland.—Itinerary.—Observations
of Natural History.*

COUNT Paul Andreani, of Milan, William Thornton, M. de Mecies, and myself, set off from London at six in the evening, in three post-chaises; two of which were occupied by ourselves, and the third by our servants.

I had been acquainted with Count Andreani at Paris; he loved the sciences, and had made a considerable aerostatic experiment at Milan, at his own expence; he went up in a large balloon, which he caused to be constructed on the plan of Montgolfier.

William Thornton is a very worthy and intelligent American, who, after prosecuting his studies, with advantage, under Doctor Cullen, at Edinburgh, had come to finish them at Paris, where he conceived a taste for natural history. The journey could not
but

but be very agreeable with such companions.

M. de Mecies, of London, had been introduced to us a few days before our departure from London, by Mr. Thompson, a very good naturalist, as a studious young man, who was much attached to mineralogy; we admitted him, with pleasure, into our party.

We loved to associate with persons who possessed the same taste with ourselves, and who were not afraid to participate in the fatigues and dangers of the tour which we meant to pursue as far as the isle of Staffa, if the season should permit us to risk ourselves on the tempestuous sea which surrounds it, and which is scattered over with islands and dangerous currents.

ITINERARY.

From London to *Barnet*, twelve miles.—
A superb road, covered with carriages, and with people on horseback and on foot, who were returning, with a fine moonlight evening, to London, from the country-houses and neighbouring villages, where they had been to recreate themselves during Sunday.

The

The air was so serene, and the night so delightful, that we resolved to profit by it in continuing our progress.

Hatfield, nine miles.

Stevenedge, twelve miles. — We arrived there at four in the morning, and reposed ourselves till nine. The inn is excellent, but very dear.

Dugden, sixteen miles.

Stilton, fourteen miles.

Nothing can surpass the beauty and convenience of the road during these sixty-three miles; it resembles the avenue of a magnificent garden.

At *Stilton*, we first began to observe, on the sides of the road, large heaps of stones, destined to repair it with.

These stones are calcareous, and of a greyish colour. They contain a number of petrified marine shells, among which I distinguished a kind of *concha exotica*, and others of a more common sort. In these stones, also, by the side of the shells, may be seen substances, which plainly appear to be pieces of wood, but which are difficult to be preserved, because being of a pyritous nature, they are easily decomposed by the air. They are

ear of a black colour, and some bituminous parts may be distinguished in them of greater solidity.

On leaving the village of Stilton, I observed, at the door of the last house, on the right, in the way to Stamford, a sort of seat of unhewn stone, consisting of a block of real volcanic basalt, mixed with some small crystals of black *schorl*, and specks of volcanic chrysolite. I asked several persons whether they knew whence that stone had been taken; but was able to procure no other information than that it had always been seen in its present place, and that they did not know whence it had been brought. As it weighs, however, two hundred weight at least, and as it is probable that it will not be removed for a long time, I invite the English naturalists, if there be any in the vicinity of Stilton, to endeavour to discover the place where this volcanic stone was procured, and to examine whether it has not been carried from the neighbouring mountains.

From *Stilton* to *Stamford*, fourteen miles.
—There are two old churches at Stamford, which are worthy of being examined. Their

construction is of a solid, but, at the same time, bold and elegant appearance. The architecture is in the Gothic style; and the execution is such as leaves nothing to be found fault with.

Wintham Common, eleven miles.

Grantham, ten miles. — A superb inn, where every thing bears the appearance of exquisite neatness.

Newark, South Muscomb, Tuxford, fourteen miles.—The road less agreeable, lying through common pasture-grounds, a little marshy. In some parts, however, there may be observed, under the turf, beds of black calcareous stone, foliated in pieces of from half an inch to four inches thick. This stone, when rubbed with iron, emits a smell like that of burnt corn. There are found in it terebratulæ, and other small shells.

Barnby Moor, ten miles.

Doncaster, fourteen miles. A handsome little village. It was not long since a balloon had been sent up here, filled with rarefied air, in the manner of Montgolfier's. I saw an account of it in a bill affixed to the gate of the inn for letting post-horses.

Ferry-

Ferrybridge, fifteen miles.—A continuation of common pasturage from Barnby Moor to *Ferrybridge*, covered with numerous flocks of sheep, and black cattle. The soil below consists of small gravel, in some places covering small beds of calcareous stone. On approaching *Ferrybridge*, the country becomes mountainous, and considerable banks of grey calcareous stone are seen. At *Ferrybridge* there is a good inn for post-horses.

Brotherton, Fairburn, Micklefield, Aberford, Bramham, Weatherby, Walshfordbridge, Allerton-Park, Boroughbridge, Dishford, Topcliff, Surshbystoope, Sandhulton, Southoltungton, North Allerton—present the same order of things, with very little difference. The road still sufficiently convenient, but not so good as before—the landscape a little wilder—some parts better peopled, but worse cultivated.

The face of the country is intersected at North Allerton with hills, consisting, for the greater part, of large, round, flint stones, or, at least, covered over with them. At intervals, however, and in the hollows, there appear some strata of calcareous stone, of a greyish white, but of an indifferent quality.

It is, notwithstanding, employed with advantage as a manure, when converted into lime.

The round blocks of stone, which cover the most of these calcareous hills, present a new face of things. They consist of *granites*, greenish *petrosilices*, and a number of black *trapps*, which it would be difficult for one who has not been very much accustomed to stones of this kind, to avoid confounding with compact volcanic lavas.

Lousamehill, Little Smeaton, Dalton, Croft, Darlington.—On leaving the little town of Darlington, we saw on the side of the way considerable heaps of black *trapps*, which had been brought from some places in the neighbourhood, to keep the road in repair.

Cottonmundbill, Aycliff, Woodham, Ferrybill, Sunderland-Bridge, Durham.—The last a small city, which is the see of a bishop, and placed in a delightful situation ; it has a superb Gothic cathedral.

Durrowmoor.—There we first observed the traces of a vein of coal, which were discovered in calcareous stone, of bad quality, and a little mixed with clay.

Paulsworth, Chester-le-street, Pelaw Birtley, Gateshead.—There are coal-mines worked at Gateshead.

New-

Newcastle.—From Ferrybridge to Newcastle is reckoned ninety-six miles. We made this long journey in one day; having left Ferrybridge, where we had passed the night, at five in the morning, and arrived at Newcastle at nine in the evening.

About four in the morning, of the 30th of August, when advanced about seventy miles on our way from London, we began to feel the weather cold and penetrating, though it was at the same time calm and serene, and the air quite pure. I inspected my thermometer, and found it half a degree above the freezing point; I saw ice, also, of about half a line thick. At the same hour of the following day, the mercury was ten degrees higher, and continued so almost the whole day.

On the second day, it was fifteen degrees above the zero of Reaumur's thermometer, and the cold was no longer felt. This shews a very great inequality of temperature at that season in England, where the winter is a little longer and more foggy than at Paris; but where it is not so cold, on account of the vicinity of the sea.

CHAPTER VI.

Newcastle.—Its Manufactures.—Its Coal-mines,

NEWCASTLE is situated on the beautiful river Tyne, which is covered with vessels, and bordered on the right and left with manufactories of every kind, down as far as its mouth, which is about ten miles from the city.

I remained in Newcastle long enough to enable me to pay due attention to its numerous coal-mines, and the multiplied produce of its most active industry.

Mr. David Crawford, who was the friend of William Thornton, one of my fellow-travellers, procured us opportunities of examining the mines, and several manufactories: he did us this service in the kindest manner, for he loved natural history and the arts himself, was very communicative, and anxious that we should see every thing that was curious; he was the proprietor of a manufactory, in which gold and silver are extracted

tracted from the cinders used in the furnaces of the workers in these metals, and also from their old crucibles: he purchases these rude materials in Holland, England, and France.

But it is remarkable, that the cinders brought for this purpose from France, are such as have already passed through the hands of refiners, who use only washing and other imperfect processes, by which means they recover only a part of the precious metals. In Newcastle, however, the abundance and the cheapness of coal enables the manufacturer to extract the gold and silver, by fusion, in reverberating furnaces, which are very ingeniously constructed.

I saw, with much interest, the manufactory of Mr. Crawford, where he has erected other furnaces for the revivification of the calx of lead and copper. He procures the materials for this operation from different parts of Europe, by purchasing old leaden pipes, which have remained long under the ground, copper which has been corroded by rust, and old cannon.

We saw several glass-houses, where window-glass, bottles, decanters, drinking-glasses, &c. were made. All these manufactures,

though established in buildings of a mean appearance, are managed with a simplicity and an economy which cannot be too much praised.

This modest simplicity is of great advantage to the country; it encourages active and industrious men to embark in trade, who would otherwise be unwilling to form large establishments, being alarmed by the expences which extensive works require, when constructed on a magnificent scale.

It is a taste for pomp and grandeur which almost always ruins the manufactures of France, and prevents those new ones which we want from being established: men are afraid to involve themselves in ruinous expences for mere warehouses and workshops.

It must be acknowledged, that the English and Dutch are much more prudent, and exhibit examples in this way, which we ought to imitate. Architecture is a part in establishments of this kind.

This beautiful river, the Tyne, is rendered highly interesting by the number and variety of the manufactures carried on upon its banks. On one hand are seen brick-fields, potteries, glass-houses, and chymical works,
for

for making ceruse, minium, vitriol, &c.; on the other, manufactories in iron, tin, and every kind of metal; machines for making brass-wire, plate-metal, &c.

This multitude of establishments, rising opposite to one another, diffuses every where so much activity and life, if I may use the expression, that the eye is agreeably astonished, and the soul feels a lively satisfaction in contemplating such a magnificent picture. Humanity rejoices to see so many useful men finding ease and happiness in a labour which contributes, at the same time, to the comforts and enjoyments of others; and, in the last result, to the prosperity of the government, which watches over the safety of all.

Compare this honourable industry with that disgraceful indolence and disgusting misery which is to be seen in Roman Catholic countries, where pernicious laws permit a great portion of the population to be buried in monastic institutions, and it will soon be discovered how much government and religion influence the happiness of mankind.

The numerous coal-mines in the neighbourhood

bourhood of Newcastle form, not only immense magazines of fuel for the rest of England, but are also the source of an extensive and profitable foreign commerce.

Vessels loaded with coal, for London and different parts of Europe, sail daily from this port. Besides this commerce, the navigation which results from working these mines, gives an incalculable advantage to the British navy. The coal-trade, as it is called, forms a great nursery of seamen; and, in the time of war, more than a thousand coal vessels have been armed, as letters-of-marque, and done considerable injury to the enemies' commerce.

In this practical school of seamanship, men accustomed to every danger are to be found. The celebrated Cook began his naval career, as a sailor, in the coal-trade; his enterprising and active genius soon raised him to the command of a vessel. He afterwards purchased a ship on his own account, and displayed so much skill and courage in the midst of the greatest dangers, when he, as it were, subdued the elements, that though yet young, he acquired a very high reputation among his brother seamen. He afterwards
entered

entered into the royal navy, where he received, from the British government, that encouragement which he so justly merited. This astonishing navigator sailed three times round the world, and enriched geography, natural history, and navigation, with great and valuable discoveries. The modest habitation where he was born, in the neighbourhood of Newcastle, is preserved with pious veneration.

The coal-mines, in the neighbourhood of Newcastle, are covered with a soil which yields fine pasture and the richest products of agriculture. Under this fertile soil there is found a freestone, of an excellent quality, for grind-stones. This second richness of the earth forms another extensive object of trade for the industry of the inhabitants of Newcastle: these stones have so great a reputation, that they are exported to every part of Europe.

The first mine I visited belonged to a private individual; it was situated about two miles from the town, and required one hundred men to work it; of whom thirty were employed above ground, and seventy in the pit: twenty horses were kept in this profound

profound abyfs, for drawing the coal through the fubterraneous paffages to the bottom of the opening of the pit, four worked the machine which raifed the coal, and fome more were employed in auxiliary labours.

The following is the order of the mineral fubftances, as they appear in defcending to the coal:

	Feet.
Vegetable earth, of good quality - - - -	2
Beds of rounded calcareous ftones, intermixed with rounded pieces of freestone - - - -	15
Grey clay, more or lefs pure - - - -	16
Hard quartzofe freestone, with lamellæ of mica - - - -	25
Very hard black clay, fomewhat bituminous, intermixed with fome fpecks of mica - - - -	26
Black clay, more bituminous, and partly inflammable; when the foliations of this clay, which feparate with facility, are examined with attention, fome prints of fern appear, but they are fcarcely difcernable - - - -	18
Total	102

At this depth of one hundred and two feet the coal is found. The bed is five feet thick in fome places, and lefs in others; but in general it is eafily wrought, and large pieces are brought up. This laft circumftance is of confiderable advantage, as thefe pieces are moft proper for chamber-fires, and eafily transported;

transported; which makes this kind of coal sell at a higher price.

When the bed of black and bituminous clay is penetrated, the coal is found adhering to it; but this is not always the case, for there are other mines in the neighbourhood where freestone is the covering, which in the points of contact is mixed with the coal to the thickness of two or three inches; the latter running as it were in splinters into the stone, and having a ligneous appearance when attentively examined.

This mine had a large steam-engine for carrying off the water, and working a ventilator to purify the air.

The machine which raises the coal from the pit is very convenient, and is worked with stout horses. The buckets, in which it is brought up, are not of wood, but of osier, strongly made. They contain at least twelve hundred weight of coal each; and as the one ascends while the other descends, one of them arrives at the mouth of the pit every four minutes. When one of these baskets comes up, a single man receives it; and while it is yet suspended, places it upon a dray drawn by one horse. He then unhooks the basket,
puts

puts an empty one in its place, and conducts the dray to a spot somewhat elevated at a short distance, and where some boards are erected in the form of a shed. He empties the basket on this kind of shed; the dust passes through holes, while the large pieces of coal rolling down the inclined plane, fall upon the ground in heaps on the outside of it. Waggon, which I am about to describe, then take it up, and carry it to wharfs on the river-side, where the vessels are loaded.

It might be expected that it would require a great number of horses and men to transport the vast quantities of coal destined for embarkation, and that this operation would occasion an immense expence. But art has supplied the place of horses, and even rendered them unnecessary. The following is the simple and ingenious manner in which this useful improvement is effected.

Roads which have an almost insensible inclination are formed with the greatest care, and prolonged to the place where the vessels are loaded. The length of these roads is frequently several miles.

This first operation being finished, two parallel lines are traced along the road, at the

the exact distance which separates the wheels of the waggons destined to transport the coal. Logs of hard wood are then laid along these two parallel lines, and firmly fixed in the earth with pins.

The superior surface of these logs are carefully cut into a kind of moulding, which is well rounded, and projects upwards. The thickness of this elevated ledge must correspond with the width of the groove in the waggon-wheels, which are made of cast-iron, and hollowed in the manner of a metal pulley.

These wheels are completely cast in one piece, in a mould from which the rim comes out hollowed. This large groove is several inches deep, and of a proportional width; so that the wheel exactly encases the projecting part of the log, from which it cannot slide in any direction. As the moulding is well greased and polished by continual friction, large four-wheeled waggons, containing eight thousand weight of coal each, move along the inclined plane, by the laws of gravity, and proceed as it were by magic in the rear of each other, until they reach the river. Arrived there, a strong wooden platform,

form, which projects above the water, adds several fathoms to the length of the road. This timber-work is very strong and ingeniously constructed, and sufficiently elevated, to permit the vessels that take in the coals to pass below it. A man who is stationed on the platform opens a hatch, and a large wooden tunnel presents itself, directed towards the vessel, the hatches of which are open. When the waggon comes to the trap in the platform, its bottom is opened, and all the coal runs in a moment through the tunnel into the vessel. The waggon being emptied, returns by a second road parallel to the first. Other waggons follow the same course after having been in this manner relieved of their contents; and in a short time the vessel is completely loaded. A few horses serve to bring back the empty waggons to the pit, and they soon return with a new load of coal. This ingenious contrivance is as expeditious as economical, and soon indemnifies the proprietors for the money they advance in constructing these roads.

I have here given but a rapid sketch of these extraordinary roads, which are varied in several manners. It would require me to
enter

enter into details which might prove too long, and ill-suited to the nature of this work, were I to describe all the ingenious means which art and industry have employed in constructing works of this kind. Where local circumstances permit the improvement, it has been contrived to combine the weight of the load, and the accelerated movement in such a manner, that files of waggons proceed down one inclined plane towards the place where they are unloaded, and return to the coal-pit empty, and without the assistance of horses, along another road parallel to the first, inclining in a contrary direction.

The great economy produced by these ingenious contrivances, which save the expence of employing a multitude of men and horses, enables the English to sell the coal which they export in such abundance to all our ports on the ocean and the Mediterranean, at a lower price than it can be afforded from our own mines, in all cases where we have to bring it more than three or four miles by land. Marseilles affords an example in point. This town, which consumes immense quantities of combustible matter in

its great soap manufactories, is within four or five leagues of a great number of coal-mines. This coal is indeed of an indifferent quality, but it is notwithstanding employed with advantage in the furnaces of soap-works. Would any one believe that the excellent coal of England, which lasts double the time, and gives double the heat, when sold duty free in the port of Marseilles, is cheaper than the former. Such instances as this ought doubtless to give us very important lessons.

The industry of the inhabitants of Newcastle is so active, that they are accustomed to apply it to every object that presents itself. They have even turned to their profit the pyrites, which injures the quality of the coal, but which is found in great abundance in some of the mines. The pyritous substances are carefully separated from the coal; and the expence which this labour may occasion is repaid with usury by the vitriol which they produce. The process by which the vitriol is extracted is at once simple and economical, and does honour to the intelligence of those who first put it in practice.

A large

A large area of ground is inclosed, to which a gentle but sensible declivity is given. The surface is made quite equal, and covered with a fat clay, which is every where extended and smoothed as if it were plaster, in order to prevent the water from filtrating into the earth. At the same time a furrow is formed in the midst of the area, calculated to collect all the water in one point, and to convey it to a reservoir.

The area being thus prepared, the pyritæ are spread all over its surface in layers one above another, to the height of several feet, and care is taken in placing the different pieces to leave intervals for the admission of the air.

This mass of pyrites, exposed to the air, the vicissitudes of the atmosphere and the seasons, soon heats, swells, and is converted into powder. The operation is accelerated by occasionally turning the pyrites with rakes that have long iron teeth, by which means new surfaces are presented to the air.

In summer, when there is no rain, it is frequently necessary to sprinkle the mass of pyrites with water. This answers two pur-

poses ; first, to wash away the salt which is already formed ; secondly, to produce by the humid warmth a kind of fermentation in the pyrites, which occasions a prompt decomposition : gentle showers are therefore excellent for forwarding this operation. Finally, the water which is loaded with vitriol finding a clay bottom, which prevents it from losing itself in the earth, flows down the inclined area, and falls into a reservoir, where it clarifies. The natural evaporation which takes place adds to its strength ; and when it is conceived to be properly prepared, it is drawn off into a second reservoir, attached to the work-houses of the manufactory : from thence it passes into coppers. It is then made to boil, and evaporate by a large fire, formed of the most inferior kind of coal ; and when the liquid is brought to a proper state, it is crystallized by the operation of cold in wooden troughs. Two or three men are sufficient to manage a manufactory of this kind, and to make a considerable quantity of copperas.

France formerly laid out a great deal of money for this martial vitriol. The dyers of Rouen, Paris, Lyons, and Marseilles, consumed

consumed vast quantities of it ; but they now procure it nearer home, since there have been established at Alais, in Languedoc, two manufactories, which make this salt almost in the same manner as those of England. It ought to be observed, however, that the French copperas is not extracted from coal, but from a very deep vein of grey limestone. Establishments of this kind may be increased to a great extent in France, which abounds with pyrites in many places ; but care ought to be taken to erect them in the neighbourhood of wood or coal, and above all, near rivers, that the advantage of water-carriage may be obtained.

The common opinion, that the English copperas is better than that of France, is mere prejudice. There is no difference between them when they are made with equal care. It is to be wished that we should relinquish a number of errors of this kind, which are founded solely in habit and custom, and are always injurious to the interest and commerce of a country.

The great quantity of coal-dust collected at the numerous pits in the neighbourhood of Newcastle, would soon become a great

incumbrance, were it not that an admirable method has been fallen upon to prevent the inconvenience, by preparations as simple as ingenious. Coal in this pulverized state is not proper for chamber fires, because it falls through the bars of the grate, and extinguishes the fire. It is fit only for glass-houses, lime, or brick-kilns, forges, &c. The consumption for these purposes is indeed very considerable, but is not nearly equal to the quantity produced by the pits, notwithstanding the great care that is taken to break the coal in large pieces: besides some kinds of coal are liable to crumble into powder, upon receiving the least shock: means have therefore been sought to render this coal proper for grates.

At Liege this kind of coal is mixed with clay, and kneaded into balls, or a sort of bricks, which when dried are hard, and may be used in stoves, and even in grates. This a pretty good method, but it is only suited to a country in which labour is cheap; such as Brabant, where the coal is thus prepared by women, accustomed from their youth to perform this disagreeable business.

A similar

A similar method would not answer in a rich country, abounding with coal-mines, and where the means employed for facilitating the working and the carriage of the coal are upon the most extensive scale; besides a fuel which every moment covers the hearth with earthy cinders and dust, would ill accord with the easy and comfortable situation of individuals in England.

It was therefore necessary to seek for a method more reconcileable to the habits of the people, and to the price of labour in this country.

That property, which belongs to the best kind of coal, of agglutinating and forming a single mass, when in a state of combustion, naturally excited the idea of endeavouring to consolidate, by means of a great fire, considerable quantities of this coal-dust.

It appears that Becher, a German chymist, gave the first hint to the English on this subject, so far back as the year 1682. He not only proposed to remove the disagreeable smell of the mineral coal, by converting it into a substance resembling charcoal, but to extract from it by the same operation a kind of tar, which he regarded

as superior in quality to that of Sweden. He informs us himself that he made very favourable experiments to this effect in England*. But on another occasion I have shewn, that though the process used by Becher was very ingenious, it presented many difficulties in the execution, and could not be carried into practice upon a large scale: besides it would cause a great waste of coal.

Since that period, more simple and expeditious means have been discovered. The coal-dust is put into a kind of kiln, which is in the first place well heated with large pieces of coal. The dust then coagulates, and runs into a mass, without losing any thing except its bitumen. When the ignited mass is completely red, large pieces of it are pulled out with iron rakes, and laid on the ground, which they scarcely reach before they are extinguished. These pieces are firm, though porous, and are excellently

* See the German work by Becker, entitled *Narrische Weisheit, und Weise Narrheit* (Foolish Wisdom and Wise Folly), printed at Frankfort in 1683, in 12mo. See also the "Essay on Coal-tar, &c. preceded by Enquiries on the Origin of Coal, and the different Kinds of that Mineral," which I published in 1790.

adapted,

adapted, not only for chamber-fires, but what is much more important, for smelting iron ore, in high furnaces. This ingenious contrivance has given birth to several new branches of industry and commerce.

The coal thus prepared is called in England *coke*, and is used in a great number of manufactories, as a substitute for charcoal, to which it is in most instances superior; producing a stronger, more equal, and longer continued heat.

Similar means for condensing coal-dust have been used in France, where it is formed into a substance almost the same as charcoal: some advantageous improvements have also been made upon the English mode of preparation.

The coal thus prepared is called in France *purified coal*, or *dephlogisticated coal*. The city of Paris uses great quantities of it, which are prepared at Moulins in Bourbonnois, at Saint-Etienne in Forest, &c. and which are transported by water upon the Loire, the Allier, the Canal de Briare, and the Seine. This admirable means of preserving our great and valuable forests is much more effectual than a thousand of those

those laws and regulations which are repeatedly made, but which tend only to their destruction.

The city of Lyons has likewise an exclusive establishment of this kind, situated near the point of Æneas *, and the purified coal prepared at Saint-Chaumont and Rive de Giers is used in the copper-works of Saint-Bell.

But, thanks to the government, and to a rich and enterprizing Company, an iron foundery, which will soon rival the best works of that kind in England, is established at Creuzot, near Montcenis, in Burgundy; though the place in which it is erected was originally sterile and solitary, it is now covered with habitations. The abundance of coal, the simple mode of preparing it as a substitute for wood, and the models furnished by the ingenious Wilkinfon, have performed wonders, and have given birth

* Since the commencement of the revolution not one bushel of *purified coal* has been brought to Paris. The trees of our finest forests are daily reduced to ashes. The establishments of Moulins, Lyons, and Rive de Giers, have disappeared, and the worthy men who erected the foundery of Creuzot, have almost all been condemned to moisten the earth with their blood.

to

to an establishment which is truly worthy of a great nation.

This short sketch is sufficient to demonstrate the numerous and incalculable advantages which this useful mineral presents to mankind.

The situation of France makes me insist with more earnestness on this truth. A country so extensive, with a population so numerous, must, when its forests are consumed, resort to another kind of fuel. Fortunately this vast country possesses innumerable mines of coal, the greater part of which have not yet been opened, and the fine rivers which intersect our territory afford every facility for the formation of canals. It is full time that we should turn our attention to this efficacious resource. To individuals it would give comfort and happiness, and to the government it would prove an inexhaustible source of prosperity and power.

I was one day with Benjamin Franklin at Passy: several learned Americans, who were profoundly acquainted with the political and commercial state of England, were of the party. I shall not name them, because

cause they have, since that period, appeared in distinguished characters ; but I heard them, with pleasure, point out the real cause which renders England so wealthy and powerful—a cause which has escaped the observation of almost all politicians. “ It cannot be doubted,” said one of them, “ but that it is the coal-mines which perform such wonders : we know that it is a sort of *leze-nation* to say so in France, where the coal is as plentiful and as good as in England ; but the French nation has secured the liberty of the United States ; and besides I wish to see the people of every country happy. I have travelled much in Italy and in France, and when I passed through the latter country, in the midst of winter, I observed, with sorrow, that the inhabitants of several provinces were in the greatest distress, on account of the want of fuel. The effect of the cold was such, that whole families were compelled to retire to their beds, where they remained in a state of torpor, unable to labour, and consuming, in a few days, all their little savings. How different is the situation of labourers
“ in

“ in England, where the winters are much
“ longer, though less severe, than in the
“ north of France! The English peasant,
“ placed beside a good fire, which, at the
“ same time, lights and warms his cottage,
“ finds himself happy and comfortable.
“ The father prepares his implements of
“ husbandry for the ensuing spring; his
“ sons assist him; his daughters spin wool
“ or cotton; the mother manages the fa-
“ mily affairs; and as the blazing fire is kept
“ up during the whole night, their labour
“ is prolonged, in defiance of the climate.
“ In their manufactories, whether in town
“ or in country, the same activity prevails.
“ The artizan never suffers from cold, and
“ is, therefore, exempt from almost all the
“ diseases of winter: thus, that season,
“ which is, in general, so fatal to the in-
“ dustry of other countries, does not dimi-
“ nish the labour of the English people;
“ and the necessary consequence of a great
“ mass of population, constantly employed
“ in pursuits of commerce and manufac-
“ tures, is an increase of wealth, equally
“ advantageous to the state and to indivi-
“ duals.”

These

These words, full of truth and judgment, made a deep impression upon my mind, and tended greatly to direct my attention to the coal-mines of England when I visited that country. Doubtless they did not escape the observation of the illustrious man before whom this conversation passed, and who was much more capable of estimating its value than I was. The following is an extract of a letter upon this subject, which he shortly after addressed to an estimable naturalist, who has honoured me with several marks of kindness: “ Wood will become
“ extremely scarce in France, if the use of
“ pit-coal be not introduced in that country
“ as it has been in England, where it at
“ first met with some opposition. Upon
“ examining the records of parliament,
“ during the reign of Queen Elizabeth, it
“ will be found, that a bill was introduced
“ by a member of the house of commons,
“ which stated, that several dyers, brewers,
“ blacksmiths, and other artizans and ma-
“ nufacturers of London, used coal for their
“ fires instead of wood, whereby the air was
“ filled with unwholesome smoke and va-
“ pours, to the great prejudice of the health
“ of

“ of the inhabitants, particularly of persons
“ who had lately come from the country;
“ and it proposed that the use of this kind of
“ fuel should be prohibited, at least during
“ the session of parliament. From this it
“ appears, that coal was not then used in
“ private houses, because it was considered
“ unhealthy. But, fortunately for the in-
“ habitants of London, they have paid lit-
“ tle attention to this objection; and they
“ now believe that coal rather contributes
“ to render the air salubrious. Indeed,
“ since its use became general, they have
“ not been subject to those pestilential fevers
“ which formerly so severely afflicted them.
“ The inhabitants of Paris are put to an
“ enormous expence by the consumption of
“ wood for fuel, and this expence is always
“ increasing, because they have still to con-
“ quer the prejudice they entertain against
“ coal*.”

While on this subject, I may refer to another, and a still longer, letter, of the founder of American liberty, in which he enters into

* *Lettre de Benjamin Franklin, tome ii, page 42, des Expériences sur divers Objets de Physique, par M. Ingenhouse; Paris, chez Baudis.*

extensive details on the inconveniencies experienced in countries where the people have neither the skill nor the inclination to supply themselves with coal, or, in case of the want of this mineral, with turf, as they do in Holland, where there is also a scarcity of wood. "Roads and canals," says he, "by which combustible substances may be transported at a low price, in such countries, are of the greatest utility, and those who assist in constructing them ought to be ranked among the benefactors of mankind." *

This digression will, perhaps, be tedious to some readers; but I trust it will be excused on account of the motive which gave rise to it. I could not avoid entering into some details upon the nature and use of coal, since it is a subject so intimately connected with the comfort of the poor, and the prosperity of my country. Unfortunately, most governments are deaf to their own interests: it would then be criminal to weary of repeating the same thing even a hundred times over, when the observation is founded upon

* *Idem*, vol. ii. page 419.

experience,

experience, and recommends a measure which would tend to promote the happiness of the human kind.

I should have wished to have remained at least a fortnight at Newcastle, in order that I might examine its various manufactures more minutely; but I could not dedicate more than five or six days to this purpose; for my principal object being a journey to the island of Staffa, it was necessary to proceed northward, lest the favourable season should pass away. We, therefore, made preparations for travelling to Scotland, and left with regret the town of Newcastle, which afforded so rich a field of observation. The evening before we set out, we took leave of Mr. David Crawford, who had shewn us so much kindness, and who insisted that I should take some specimens of the natural history of the country, which he had selected for me.

CHAPTER VIII:

Departure from Newcastle. — Itinerary. — Basaltic Lava. — Trapp. — Porphyry. — Fine Rock of Trapp at Dodmill, near Thirleston. — Trapp of different Colours near Channel-kirk-Inn.

AS it required some time to arrange my notes, and to pack up the different specimens of stone, coal, and other fossils, which I had collected, it was two in the afternoon before we found it convenient to leave Newcastle. The remaining part of the day was sufficient to enable us to reach Wooler, which is at no great distance.

Travellers who love natural history commonly take a pleasure in examining those collections of broken stones, so frequently to be met with heaped up on each side of public roads, and which they are destined to repair. They present an easy means of acquiring, if not a perfect knowledge, at least a pretty correct idea, of the physical and geological state of a country. Thus bridges
and

and highways, which open so many useful communications, and prove so beneficial to the public, merit also the gratitude of the naturallist.

It will have been observed from the Itinerary which I have sketched, that limestone, either in rocks, banks, or in beds, is found all the way until very near Newcastle; but it ought to be remarked, that in proportion as the calcareous substances disappear, their place is occupied by vast deposits of pebbles and rounded flints, which form entire hills, and descend to a great depth in the earth. Sometimes the pebbles alternate with beds of freestone, gravel, argil, and other transported substances, which cover the coal-mines of Newcastle. This indicates a sudden and rapid revolution, which has produced great changes, and accumulated by the force of currents substances frequently of an heterogeneous kind. The line of separation between the limestone and the granite is always distinguished by a sort of intermediate zone, which merits all the attention of naturalists.

Here are usually found coal, hæmatites, ochreous iron ore, and sometimes lead ore:

with regard to the ores, indeed, this arrangement may experience some exceptions; but in the numerous observations which I made, I found no variation in the order of the other substances. I always found pebbles, rounded flints, breccias, pudding-stones, gravel, and quartzose grit, frequently mixed with spangles of mica, in this intermediate girdle, which seems to separate the calcareous hills from the chains of granite.

From Newcastle to Wooler, the heaps of stones collected for repairing the road are, throughout the whole of that distance, composed of black basaltic lava broken in pieces. I do not know whence these lavas are brought: they may have been transported by sea, or by the canals which afford the greatest facilities for bringing them to this place. I saw nothing of a volcanic nature near the road.

In approaching Wooler, we enter among porphyries; and blocks, of a considerable size, may be every where seen, scattered here and there in the fields, by some great revolution. The feld-spar of these porphyries is less durable than the rest of the stone, is partly destroyed in some blocks, and
appears

appears corroded and carious in others; thus the porosity of these porphyries is such, that, to a certain depth, they have the appearance of burnt stones, but they are entire, and have not been touched by fire. They resemble very much the porphyries of the mountain of Esterelle, in Provence, on the road from Frejus to Antibes, which are covered with pores, solely in consequence of the decomposition of the feld-spar.

From Wooler we proceeded to Cornhill, crossed the Tweed, and entered Scotland, passed through Coldstream, Greenlaw, and Thirleston.

The country, near Cornhill, is every where covered with rounded trapps, which very much resemble basaltes; and it is necessary to pay particular attention to this subject, since these trapps, which are absolutely foreign to volcanos, are, notwithstanding, accidentally mingled with real lavas of a black compact kind, which the same revolution has collected together. The same order of substances continues almost to Tibby's inn.

But it is at a short distance from Thirleston, near Doddmill, and by the side of a
M 3 bridge,

bridge, under which the stream that turns the mill flows, that the curious observer must place himself, in order to view with advantage a deposit of trapp so considerable, that it would be difficult to find any where else so many vast masses, and so many varieties thus fully laid open.

This local circumstance is owing to the little river which precipitates itself in cascades against the banks of this stone. It is obvious, from the width of its bed, and the ravages which it has committed, that the rivulet, though inconsiderable in summer, must be a furious torrent when swelled by rains or melting snows. It has completely uncovered the craggy exterior of this mass of trapp, the different beds of which, more or less thick, are disposed in the form of steps, and seem justly to warrant the application of the name which the Swedes have given to this stone*. I certainly did not expect to find, near the road, so fine an object for study. The moment we observed it, we proceeded to the bed of the torrent, where we employed a considerable time in

* *Trappa*, in the Swedish language, signifies *stairs*.

examining the different substances, observing their position, their form, and the various adventitious matters which attracted our attention, and in collecting such mineralogical specimens as chiefly interested us.

Throughout a considerable extent we distinguished parallel beds of black trapp, several of which were two feet thick, others one foot, and some four or five inches, and even less. The hardest strata repose upon a finer, a less compact, and a less adhesive kind of trapp. The action of the current destroys the last sort throughout its whole length, occasions breaches and hollows, on which the feet may be placed, and by which this mass of trapp may be easily ascended.

To the trapp, which is the hardest, heaviest, and of the roughest grain, there succeeds a stone, which resembles it at first sight, but which is of a finer composition, when exposed to the air separates into very thin lamellæ, and is found to be maculated with mica. It is known that there is a kind of trapp which decomposes in the air, and which, in that state, might be taken for argil. Near the same place, the system of beds is, to a certain distance, interrupted by

prisms: the matter must have adopted this form during the period of the drying of the masses, accumulated and deposited by the aqueous fluid, for it is certain that there is nothing here of a volcanic nature.

The trapp seems also sometimes to shoot into veins, in which there appear holes of the size of man's head; but it appears that these cavities, the edges and internal parts of which are smooth and polished, owe their formation to the force of the torrent, which attacks and destroys the more tender parts of the trapp.

Finally, it is proper to observe, that the mass of trapp which I have described is, at it were, planted in a hill of porphyry, to which it adheres. The last stone is found in a very advanced state of decomposition, for it is almost entirely converted into earthy matter.

The hill of Doddmill is contiguous to a ridge of other hills nearly similar, which skirt the highway, and which stretch beyond Channel-kirk-inn. It exhibits several veins of trapp, which cross sometimes an entire rock of porphyry, sometimes a substance of an argillaceous appearance, and which is occasionally grey, greenish, brown, or of the colour

colour of rusty iron, crumbles, exfoliates, and seems to be of the same texture with the basis of porphyry. The crystals of feldspar, which constitute porphyries, are, indeed, in general wanting; but I have collected specimens, in which some of them are to be found*.

The following are the principal varieties of trapp which I met with at Doddmill, or in the contiguous hills on the road to Channel-kirk-inn.

1. Hard black trapp †, of a fine dry grain, and having a resemblance to volcanic basaltes, but which is not, like it, magnetic, is less hard, and yields a powder of a greyer colour.

2. The same trapp †, intersected by some veins of white quartz.

* There is a similar substance at Renaison, in the mountains of Forest, where there may be seen very fine specimens, in which the porphyric basis is entirely destitute of the crystals of feldspar on one side, while on the other they appear in parallelopipeds, and form perfect porphyry.

† *Corneus trapezius colore nigrescente, vel obscuro.* — Waller, vol. i. page 363. *Trapezum nigrum particulis impalpabilibus, lapis lydius.* Deborn, page 161.

† Faujas, *Essai sur les Roches de Trapp.* Variété 16, page 107.

3. Trapp

3. Trapp of a blueish-black colour*, maculated with dots of red and green feldspar, which assume no regular crystalline form. These specimens may be considered as exhibiting a passage from trapp to porphyry, but which is here only in its commencement.

4. Black trapp, of a very fine grain†, delicate and fissile; and in which some spots of mica may be observed. This variety adheres to the hardest trapp: it is sometimes found interposed between beds of solid trapp, sometimes in deposits of a substance of the nature of that which forms the basis of porphyry.

5. Brown trapp, of a less fine grain‡, in which may be distinguished ferruginous spots changed into brown ochre: the colour of this trapp is evidently owing to the decomposition of iron.

These five varieties abound at Doddmill;

* *Trapezum spato scintillante rubescente mixtum.* Deborn, page 151.

† *Saxum corneo et mica mixtum, saxum corneo micaceum fissile colore nigrescente.* Waller, vol. i. page 420.

‡ Faujas, *Essai sur les Roches de Trapp.* Variété 6, page 92.

they

they are not affected by acids, and have no influence upon the magnetic needle.

6. Purple coloured trapp*, adhering to black trapp. I only mention this variety to shew, that the iron, in decomposing, may experience various modifications in its colour; for this violet trapp is incontestibly the same as the black trapp, with which it forms one body, and on the face of which may be traced the gradations of change in the colouring principle.

7. Trapp†, the ferruginous particles of which are changed into an ochrey red: this modification of the iron has impaired the cohesion of the parts, so that this trapp is not so hard as that in which the decomposition is less advanced.

8. Trapp, of a yellowish-grey colour‡. If this kind be not examined with attention, it may be mistaken for freestone, though it is really of a very different nature: its appearance will easily deceive. Like the other kinds it adheres to black trapp, of

* Faujas, *Essai sur les Roches de Trapp*. Variété 6, page 92.

† *Corneus trapezius rubens*. Waller, vol. i. page 362.

‡ *Corneus trapezius solidus griseus*. Ibid.

which

which it is only a modification, the constituent elements of both being the same.

9. Dull violet coloured trapp*, approaching the state of real porphyry, in consequence of the addition of crystals of white feld-spar.

This porphyric trapp joins to the black trapp, and lies like it in projecting strata, resembling stairs. In some places, these strata succeed each other without any interruption; in others, they are crossed by beds of pure and entire black trapp. This porphyry also varies considerably in its colour, according to the greater or less degree of its hardness, or the quantity of feld-spar it contains, which appears sometimes in dots, sometimes in unformed grains, and at other times in regular crystals. On the one hand, some portions of substances are destitute of feld-spar, while on the other the contiguous parts contain it.

In short, this vast deposit, this immense accumulation of materials proper for the composition of porphyry, and which form a ridge of hills, from Doddmill to Channel-

* Faujas, *Essai sur les Roches de Trapp*. Table synoptique, variété 29, page 148.

kirk-inn, seems to exhibit the effect of a sudden operation of nature, of a confused and tumultuous precipitation, which has prevented the homogeneous substances from mutually attracting each other, and obeying those laws of affinity by which regular compositions are formed.

Nature, considered under this point of view, is certainly not without interest, for him who delights in studying her magnificent operations. I should wish to see this superior kind of chymistry associated with that of our laboratories.

I have, perhaps, dwelt too long upon a subject which cannot be generally interesting; but the hills of Doddmill and Channel-kirk-inn being situated on the road to Edinburgh, I have thought it of consequence to point them out to those who consider the materials that enter into the formation of mountains, objects worthy of their attention and inquiries. It would be difficult to find a place more favourable for this study, since here it may be said, Nature displays herself uncovered, and affords the observer an opportunity of tracing the manner in which she rudely sketches or perfects porphyry, with a basis of trapp.

The

The stay we made at the foot of these hills being very agreeable, the time passed away insensibly, and we did not arrive in Edinburgh until half past nine in the evening. Our postillions conducted us to Dunn's hotel, a magnificent inn, decorated with columns; but the inside of which, though very neat, did not correspond with the exterior grandeur of the edifice.

Next day we waited on Doctor Black and other learned men, for whom we had letters: we took only a rapid view of the town, and, notwithstanding the kind reception which all the gentlemen to whom we were recommended were eager to give us, we delayed the pleasure of paying our respects to them more particularly, until we should return from the Hebrides. The season was already so far advanced, as to give us reason to fear the dangers of the sea, which environs these islands. We intended besides to pass a few days at Glasgow, on our way to the highlands, because we could not have the opportunity of seeing that city on our return, having determined to come back by Perth: we therefore agreed to make, at present, but a short stay in Edinburgh.

CHAPTER VIII.

Doctor Swediaur—Prestonpans, its Manufactories and excellent Oysters.—Grand Iron Foundery of Carron.—Stirling.—Departure from Edinburgh.

I HAD the unexpected pleasure of meeting, in one of the streets of Edinburgh, a learned German, whom I had seen some years before in Paris, at the houses of Abbé Fontana of Florence, and Doctor Ingenhoufz, with whom he was connected by scientific pursuits. It was Doctor Swediaur, a physician, who had long resided at London, was particularly conversant in the knowledge and treatment of the venereal disease, and had published upon that subject a work full of new views derived from profound study and a skilful practice *.

* Doctor Swediaur is now in Paris, employed in preparing a second edition of his work, which is to be enlarged by another volume. This book will be found to contain some new and interesting historical researches, and a number of observations calculated to promote the knowledge of this disease and its treatment. He is to publish it in French.

He

He told me, that wishing to enjoy a little repose, and to amuse himself with the chymical arts, in which he was deeply skilled, he had quitted the capital of England, and had purchased an estate about five miles from Edinburgh, in the village of Prestonpans, and by the sea-coast; where he intended to establish a manufacture of sea-salt, principally with a view to separate the mineral alkali from the muriatic acid.

He begged that I would go to see the works which he had begun to construct, and as I had but a short time to remain at Edinburgh, it was agreed that I should go to dine at his house the next day.

Prestonpans is very advantageously situated for the establishing of manufactures; the proximity of the sea, and the abundance of pit-coal found in the neighbouring mines render it extremely convenient for this purpose. The coal of the place, which is the same as that used at Edinburgh, has the merited reputation of being of an excellent quality. It burns with a vivid, bright, and long-continued flame; its cinder is grey and light. The only fault found with it is, that it is consumed a little quicker than the Newcastle
castle

castle coal; but I should prefer the Edinburgh coal to that of Newcastle; I do not know any that makes a more agreeable fire.

Swediaur shewed me at Prestonpans the seat of the greatest manufactory of the oil of vitriol in Britain. I say the seat only, because the whole of the place is surrounded with a very high wall, which does not permit the eye to discover even the chimney tops of the works. A small harbour has been contrived to admit the vessels which bring the sulphur; but every thing is so carefully enveloped in mystery, that the harbour itself is surrounded with walls of a great height. All is concealed in this manufactory, and none can enter but the persons in employment. The only thing known is, that the oil of vitriol (sulphuric acid) which it produces, forms an article of very extensive commerce. I do not suppose, however, that the processes employed here can differ much from those which are generally known, and which consist in burning the sulphur in chambers lined with lead. The suffocating smell perceived at a distance seems to announce that they are the same. But they may have some processes here for recti-

fication, or other purposes, which they are desirous of concealing.

A great deal of sea-salt is also made at Prestonpans, for home consumption, and as an article of commerce. It is produced by means of fire and evaporation. We found no difficulty of admission to the salt-works, which are very numerous.

The sea-water is raised by pumps into immense boilers, of an oblong square form, which are not at most above eighteen inches deep, and are constructed of strong plates of iron closely joined to each other. The boiler is supported on strong bars of cast-iron. The furnaces are placed immediately underneath, and divide into several vents which reach to the extremities of the boiler. There are four or five of these furnaces to each boiler, according to its surface, and they are supplied with fuel of pit-coal. The water is by this means kept in continual ebullition; and fresh supplies are pumped in, in proportion to what evaporates, until the salt is formed in a quantity sufficiently large to be taken out. By this simple process, there is procured a white salt of very good quality, excellent for cookery and other uses, but not very

very proper for curing provisions, nor so good as French salt for that purpose.

I observed in these salt-works, where artificial ebullition supplies the place of natural evaporation, that the atmosphere is always a little loaded with marine acid in the form of vapour, which quickly corrodes and destroys the polish of steel. I experienced its effects on the buttons of my clothes, which were covered with rust in about ten minutes. This vapour also affects the smell, and is somewhat injurious to the lungs.

This is certainly not the marine acid disengaging itself from the mineral alkali; their union is too intimate for that supposition. The most violent fire acting upon sea-salt volatilizes rather than decomposes it; an intermediate substance is always necessary for the latter purpose. But there is sometimes found in salt a small portion of the muriatic acid, united with magnesian earth; and as this basis fixes it but feebly, it is capable of being disengaged by ebullition.

Doctor Swediaur conducted me to the piece of ground which he had purchased; where the works for making salt were considerably advanced; the boilers being already erected.

erected. I saw all these operations with much interest.

I eat some excellent oysters at the table of this learned physician. This was not to be wondered at, as I was in the place where the best oysters are taken in abundance; they are found in great quantities on banks at a little distance from the shore. They are large, plump, and of an exquisite taste; and are held in such estimation, that they are exported to the principal cities of England and Holland. Large quantities also are pickled, put into barrels, and sent wherever there is a demand for them.

The position of Prestonpans, and its proximity to the city of Edinburgh, render it very agreeable; and one who loves study and tranquillity may here spend some very happy hours. It is therefore, not surprising that Swediaur, fatigued with the bustle of London, should have given this spot a preference, and have settled in it, for the more uninterrupted prosecution of his studies and useful occupations.

I passed a very instructive day at his house, and returned with him in the evening to Edinburgh. He had the goodness to accompany

company me back, with the intention of conducting me the next day to Carron, to visit the greatest iron-foundery in Europe, but where it was impossible to obtain admission without very strong recommendations. Swediaur was acquainted there; and I esteemed myself very fortunate in being able to make so useful an excursion under his auspices.

From Edinburgh to Carron are reckoned thirty-six miles; but the road is excellent. Count Andreani Thornton and myself set out in company with Swediaur at six in the morning. We did not alight till we reached *Linlithgow*; where we took some refreshment. We then proceeded to *Falkirk*, and about half past three in the afternoon we arrived at Carron. The soil from Edinburgh to the very entrance of Carron was strewed with large round blocks of basalt. This volcanic lava, broke into small pieces, is used for hardening the road; and there can be no better nor more durable roads than such as are made of this substance.

Immediately on our arrival, Swediaur wrote a note to a person belonging to the manufactory, with whom he was acquainted. An answer was returned, that it was necessary

cessary to leave the name, designation, and residence of each of us. The demand was instantly complied with; and a few minutes after we were told that we were at liberty to enter.

A man attended us at the gate, who said that he was ordered to conduct us every where, with the exception of the place where the cannons are bored, which no stranger was permitted to see.

He conducted us at first into an immense court, surrounded with high walls and vast sheds. This place was covered with cannons, mortars, bombs, balls, and those large pieces which bear the name of carronades. Amidst these machines of war, these terrible instruments of death, gigantic cranes, capstans of every kind, levers, and assemblages of pulleys, serving to move so many articles of enormous weight, are erected in situations convenient for that purpose. Their various movements, the shrill creaking of pulleys, the continued noise of hammers, the activity of those arms which give impulsion to so many machines;—every thing here presents a spectacle as new as interesting.

Under the sheds where the finished articles

cles are deposited, we saw several rows of rampart cannon, battering guns, and field-pieces, destined for Russia and the Emperor. They were longer than ordinary, of the most perfect workmanship, and covered with a thin varnish, of a steel colour, to preserve them from rust. Their carriages were of cast iron, and possessed the greatest simplicity of construction; they appeared to me to unite the merit of the strongest solidity, to that of being free from the numerous appendages belonging to wooden carriages, which serve only to render the working them more difficult, to obstruct their motion, and to occasion the necessity of frequent repairs.

The substance which the cannons are varnished with is kept a great secret; but I am inclined to think, that it is composed of a fat desiccative oil, to which there is added a certain portion of varnish of amber, mixed with plumbago*.

The large buildings where the cannons are bored are not at a great distance from

* For my own satisfaction, I have made several experiments with these ingredients, and they seemed to answer the same purpose.

the first yard. We passed close by them; but were very politely told, that particular processes and machines unknown to every other establishment of the kind, rendered it necessary to keep that place concealed from strangers. We thought this was very reasonable, and followed our conductor to another quarter*.

He conducted us to the works for smelting the ore; where four furnaces, of forty-five feet in height, devoured both night and day enormous masses of coals and metal. One may from this judge of the quantity of air necessary to feed these burning gulphs, which disgorged, every six hours, whole floods of liquid iron. Each furnace is supplied by four air pumps, of a great width; where the air, compressed into iron cylinders, uniting into one tunnel, and directed towards the flame, produces a sharp rustling noise, and so violent a tremor, that one not previously informed of it, would find it difficult

* I have seen the instruments with which cannon are bored at the foundery of Creuzot, near Montcenis, in Burgundy. The precision of these vast and superb machines, which are moved with water, raised by steam engines, is most wonderful: I doubt whether it is surpassed by the engines of Carron.

to avoid a sensation of terror. These wind machines, this species of gigantic bellows, are put in motion by the action of water. Such a torrent of air is indispensably necessary to support, in the highest state of ignition, a column of coal and ore forty-five feet high; and it is so rapid and active, that it projects a vivid and brisk flame more than ten feet above the top of the furnace.

An open area, of very great extent, built in the form of a terrace, and on a level with the upper aperture of the fire-places, is appropriated to the reception of the supplies of ore and coals; and on this platform are also spacious areas, where the coal is prepared for use. As the coal used here consists almost wholly of large lumps, the process by which they convert it into *coke* is completely different from that employed at Newcastle, where the coal dust only is applied to that purpose. At Carron foundery, this business is done in the open air, and in the most simple manner. A quantity of coal is placed on the ground, in a round heap, of from twelve to fifteen feet in diameter, and about two feet in height. As many as possible of the large pieces are set on end, to form passages

passages for the air; above them are thrown the smaller pieces, and coal-dust, and in the midst of this circular heap is left a vacancy of a foot wide, where a few faggots are placed to kindle it. Four or five apertures of this kind are formed round the ring, particularly on the side exposed to the wind. There is seldom, indeed, occasion to light it with wood; for these purifying works being incessantly in action, they generally use a few shovels of coal already burning, which acts more rapidly than wood, and soon kindles the surrounding pile.

As the fire spreads, the mass increases in bulk, puffs up, becomes spongy and light, takes into one body, and at length loses its bitumen, and emits no more smoke. It then acquires a red, uniform colour, inclining a little to white; in which state it begins to break into gaps and chinks, and to assume the appearance of the under part of a mushroom.

At this moment, the heap must be quickly covered with ashes, of which there is always a sufficient provision around the numerous fires where the *coke* is prepared.

This method of spreading a large quantity of ashes on the fire to deprive it of air, is similar

similar to that used in making charcoal, which is covered over with earth. The result is also pretty much the same; the pit-coal, thus prepared, being light and sonorous, and producing the same effect in high furnaces as charcoal. This is a quality of extreme importance; since, by means of charred pit-coal, founderies may easily be established in places where the want of wood would otherwise render it necessary to abandon the richest mines of iron.

There is such a numerous series of these places for making coke, to supply so vast a consumption, that the air is heated to considerable extent, and that during the night the sky is entirely illuminated with the flames. When one observes, at a little distance, so many masses of burning coal on one side, and so many volumes of flame, darting to a great height above the high furnaces, on the other—and at the same time hears the noise of weighty hammers striking upon resounding anvils, mingled with the loud roaring of bellows—one doubts whether he is at the foot of a volcano in actual eruption, or whether he has been transported by some magical effect to the brink
of

of the cavern, where Vulcan and his Cyclops are occupied in preparing thunderbolts.

I wished that Volair, the painter of Vesuvius, who so well expressed the terrific aspect of that volcano during its most violent nocturnal eruptions, had been here to exercise his pencil on this artificial volcano, which is no less striking in its appearance than the other.

The supplies of ore are on the same terrace with the coals. A canal *, dug at a great expence, and which communicates with the sea, serves to convey all the materials used here, and to transport its manufactured productions.

Three kinds of ore are employed here, which are stored up in distinct and separate heaps.

The first consists of a decomposed hæmatites, which is procured from the county of Cumberland. It is of a reddish appearance, soft to the touch, and stains the hand nearly of a blood colour : it is very rich in iron.

The second is a hard rocky substance, of a yellowish brown colour.

* The Forth and Clyde navigation.

The third is of a deep iron-grey colour, sometimes inclining a little to violet, and is remarkable for being formed in *geodes* (*septaria*), of a round or oval form, a little flattened. The largest of these geodes are about eighteen inches in diameter, and the least from four to five inches.

On placing them on one edge, and giving the other a hard smart blow, with a hammer, which breaks them into two pieces, one is agreeably surprised to see their interior filled with a multitude of very distinct, small prisms of three, four, and five sides, and separated from each other by filaments, or streaks, of calcareous white spar, and sometimes of ponderous spar, and white or yellowish spathose iron.

These prisms consist of the same matter with the geodes, that is of a kind of a hard unctuous iron ore, which at first has rather the appearance of a deep grey argillaceous stone, than of an ore of iron. The prisms, which must be considered as the result of contraction, when the substance of the geodes was soft, are from three to four lines broad, and from two to three inches long. Their forms are very perfect and regular;
and

and in some of the largest the prisms are so multiplied, and disposed with such order, that they resemble, in miniature, those fine basaltic colonnades, commonly known by the name of Giant's Causeway.

This species of iron ore is obtained in great abundance from a hill near Dunbar, a small town in Haddingtonshire, about thirty-six miles from Edinburgh, close by the sea, and, consequently, very convenient for the conveyance of the ore. It affords a great quantity of iron, which one would not expect from its appearance to the eye; but analysis and experience have proved that it is valuable. It is necessary to calcine it before it is put into the smelting furnace.

By the due intermixture of these three ores, there is obtained a grey, crude iron, of a good quality, which is applied to the most extensive uses. It is so soft as to yield easily to the fire; and, as it is also very pure, may be moulded into the most delicate forms.

It may justly be supposed, that it was not without repeated unproductive experiments, processes, and expences, that this establishment arrived, at length, at its present high state of perfection, in which every thing is
appointed,

appointed, every thing is executed, with such uniform precision, that nothing is entrusted to ordinary routine or chance.

The minerals are intermixed with method, carefully weighed, and put into baskets of equal dimensions. The same attention is observed with respect to the coals. Every thing is placed in regular order, within reach of the founders, under sheds appropriated to that service. The baskets for each charge are always counted out; a clock, erected near the large furnaces, determines the precise time of putting in the charge. The same form is observed with respect to the discharging of the furnaces; the stroke of the bell announces the moment when they should proceed to that operation; and every one of the workmen flies to his post.

We visited the place where the crude iron is refined in reverberatory furnaces, to be afterwards cast into cannons, mortars, howitzers, bombs, balls, &c. We saw, also, that where the moulds are prepared, and another place where they are dried.

We were then conducted into a vast fabric, which suggested the most pleasing ideas,

ideas, for its productions consisted of the various implements of agriculture, the arts, and domestic use; in this place were made coppers of five feet diameter, for the making of sugar in the West-Indies; stoves, in the shape of an antique urn, mounted upon pedestals; hearths of all kinds, and of the finest fashions for pit-coal fires; kitchen ranges, with all their appendages, boilers, tea-kettles, sauce-pans, neatly and solidly tinned; spades; hoes, of different sorts, for cultivating the sugar-cane, which were ground to a sharp edge on large whet-stones; basso-relievos, of the most excellent model, for chimney backs: in one word, every thing, even to cast iron hinges and bolts for doors; and the greater part of these productions are sold at so moderate a rate, that a man of very slender fortune may here procure many articles of necessity, and even of ornament, which cannot be obtained elsewhere at three times their price. But labour and workmanship are, in this place, assisted by so many machines and ingenious processes, that its commodities are executed, both in a shorter time and with greater perfection, than in other establishments of the same kind.

I should

I should not forget to notice a very simple machine, which serves to grind and reduce to a very fine powder the charcoal used for sprinkling over the moulds; it consists of a kind of mortar of cast-iron, several feet in diameter, closely shut with a wooden cover, perforated in the middle, to admit the passage of a vertical cylinder, which forms the principal mechanic power of the machine, being turned round on its own axis by a wheel, which is moved by water.

Two iron bars pass horizontally through the bottom of the vertical axis, in the manner of a cross, and they may be raised or lowered at pleasure, by means of several holes, at different distances, in the axis.

This cross divides the area or capacity of the mortar into four portions, two of which are occupied by two iron balls, nearly as large as ordinary bombs, but entirely solid, and of a polished surface. The moment the axis is put in motion, the balls begin to roll round after each other, and thus speedily bruise the charcoal. But as by this means the latter might be compressed only, without being reduced to a fine powder, the two other spokes are furnished with teeth in the man-

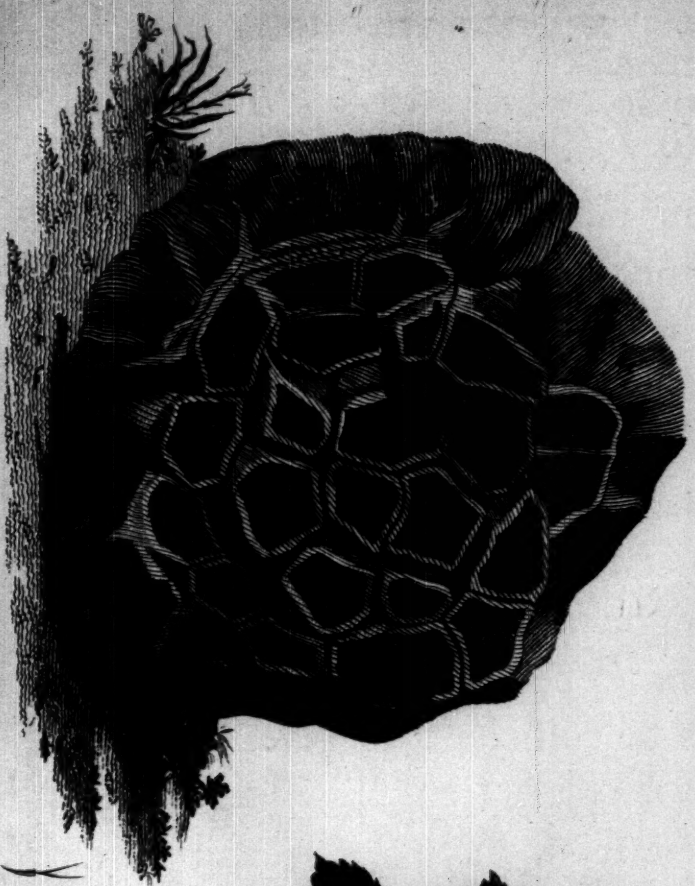
ner of a rake, which stir up the charcoal from the bottom of the mortar, and turn it on every side; so that in a very short space of time, and with little trouble, whole sacks of charcoal may be ground to an impalpable powder, without any loss of substance.

Conceiving that a correct representation of a geode of Dunbar, as it appears on being broken, might be interesting to naturalists, I caused one to be drawn in its natural size, which will be sufficient to give an idea of the others (see plate I.*). The largest differs from this only in having a greater number of prisms. Sibald, in a work entitled *Scotia Illustrata*, printed about two hundred years ago, gives a representation of this ore, which was known even at that period; but the engraving seems to have been taken from a simple sketch only, which badly expresses the object.

It is time that I should leave the foundery of Carron, and proceed to other objects. I should wish to have said more respecting it

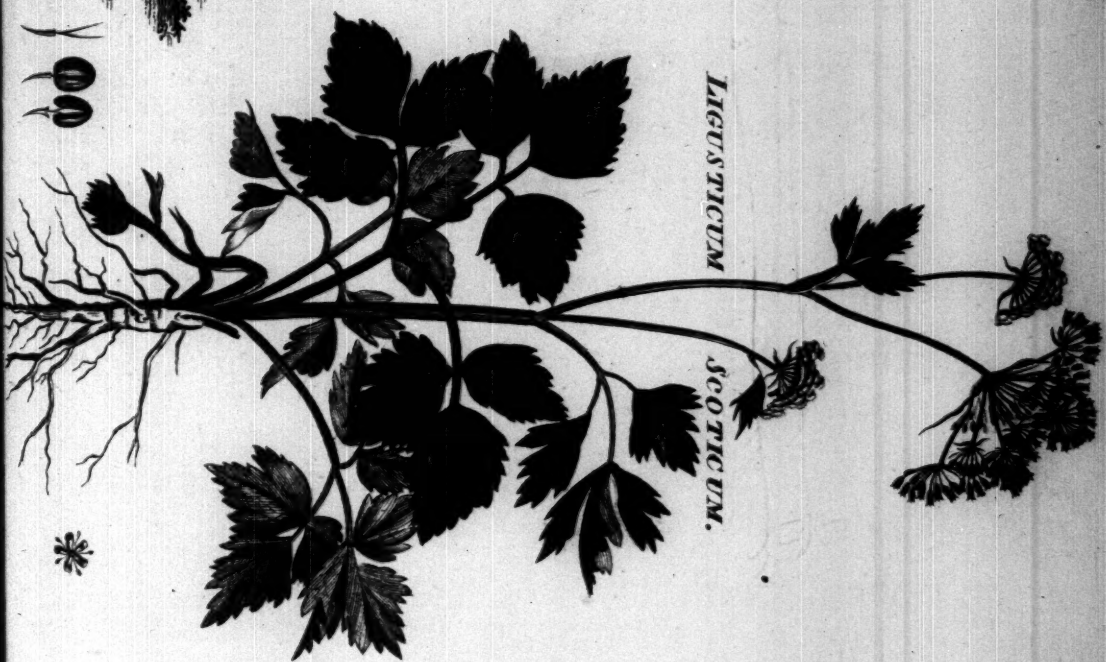
* In an essay on the theory of the earth, printed at Edinburgh, in 1785, Doctor Hutton has also given an engraving of a specimen of the prismatic ore of Dunbar.

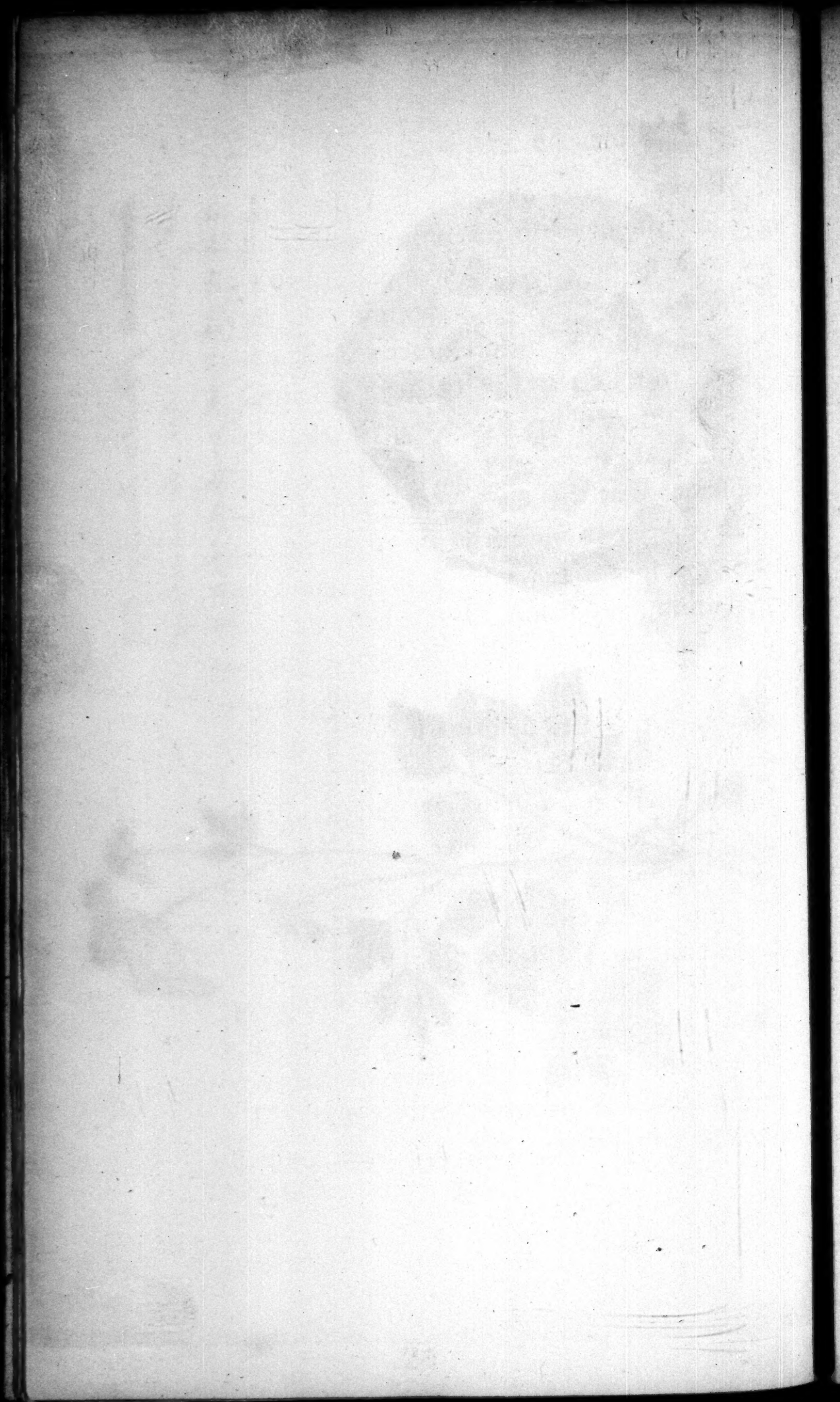
IRON STONE of Dunbar forming a Grotto
with prismatic Septa the interstices of
which are filled with ponderous Spar &
white calcareous Spar



LEGUSTICUM

SCOTICUM.





in fewer words; but, whilst I directed all my attention to so interesting and complicated a manufactory, I was obliged to trust solely to my memory for retaining the facts; for it was not to be presumed that I was at liberty to take notes of them in writing. I was therefore obliged to occupy a part of the night in digesting my observations. I am conscious that there are many things which I have not sufficiently investigated, and others respecting which I have gone into too minute a detail. But when one views an object so rapidly, that is, when one has not time to view it well, it will be impossible for one to describe it well. Others may have had better opportunities, and I request that they will correct such omissions and errors as have escaped me.

As we were at no great distance from Stirling, we went on the next day to see that small city, formerly the residence of the kings of Scotland. There is still standing a wing of the ancient palace, which exhibits the remains of former grandeur, and is now occupied by the governor of the castle. We likewise visited the parliament-house, which

consists of an apartment one hundred and twenty feet long, but now in a decayed condition. The doors are of oak, and covered with basso-relievos, and very ancient inscriptions. I had not sufficient time to make a drawing of them, nor of some other basso-relievos in stone, which I saw fixed in old walls near the market-place.

These pieces of sculpture, which had the appearance of sepulchral monuments, are done in a singular style, somewhat resembling that of the Egyptians; they consist of figures wrapped up in a covering like the swathing of mummies.

This city is very ancient: the Phenicians traded to Cornwall for tin; and it is therefore not improbable that that travelling and commercial people might have had some *entrepôt* in this part of Scotland. Its monuments, if we may judge by those of Malta, discover an evident resemblance to the monuments of the Egyptians, as far at least as respects the tombs of the latter. I merely mention this by the way, to induce the antiquarian society of Edinburgh to verify or refute my conjectures.

I wished

I wished much to have had an opportunity of paying my respects to Lord Kaim, who carried agricultural improvement to so high a pitch of perfection, on an estate which he possessed at a small distance from Stirling; but I was told that he was then at London; by which I was deprived of the pleasure of seeing a man who was so highly respected and esteemed for his private virtues, and his love of rural life.

We went round the extremity of the arm of the sea, called the Frith of Forth, which terminates at Stirling, near the mouth of the river Forth, from which it derives its name; and proceeded through Alloa, Clackmanan and Culrofs, where there are coal-pits of very excellent quality.

The ground is covered with compact lavas, and other lavas formed by volcanic eruptions of mud. The beds of coal, which are more than a hundred feet beneath the surface, have remained untouched by the heat of the lavas above them. But it is very remarkable, that these rich mines of coal extend to a great distance under the bed of the sea, and that the workmen, guarded against a few leaks by steam-engines,

which raise the water out of the pits, continue their labour in perfect security, and without the least anxiety from the enormous mass of water rolling over their heads.

Thus, while the bold and indefatigable miners, feebly lighted by the dismal glimmering of their lamps, make these profound cavities resound with the strokes of their mattocks, vessels, borne along with a propitious breeze, pass in full sail over their heads; and the sailors, enjoying the fineness of the weather, express their happiness in songs. At other times the tempest lowers, the horizon flashes with fire, the thunder roars, the sea rages, all is wrapped in terror, and the crew tremble. But the tranquil miners, ignorant of what is passing aloft, joyful and happy, sing in chorus their pleasures and their loves, whilst the vessel is dashed in pieces, and swallowed up in the devouring gulph above them.—Unfortunately, too true a picture of the daily vicissitudes of human life!

From Culrofs we proceeded to Inverkeithing, where we crossed the Frith of Forth to Queensferry, and regained the road to Edinburgh.

As

I intended, on our return from the Hebrides, to make a sufficient stay at Edinburgh to permit us to become more particularly acquainted with that city and its environs, I shall postpone my observations respecting them till that period. We made every preparation to be able to leave Edinburgh by the next morning; and that we might have nothing to do but to step into our chaises, we settled our reckoning at night. The charges demanded of us were more than double the rate of those which we had paid at the best and dearest inns on the road; though, as generally happens, we were nowise better entertained. The bill presented to us was more than an ell long, and decorated with flowered borders; and, to prove that nothing was omitted in it, they had not failed to set down half a sheet of paper, which one of us had called for, to save the trouble of opening his portfolio.

	<i>l.</i>	<i>s.</i>	<i>d.</i>
To paper . . .	0	0	3
To a porter for bringing			
the same . . .	0	0	3
that is in all about twelve French sous.	We		
	0 4	paid	

paid the bill without saying a word, but we took care not to return again to Dun's hotel to lodge, under columns less heavy than the rapacious hand of the landlord.

CHAPTER IX.

Departure from Edinburgh.—Livingston.—Moorhead craigs.—Prisms of Basaltes.—Hearsthill.—Ball of Basaltes.—Compact Lavas.—Peats.—Pit Coal.—Glasgow.—Natural History.

FROM Edinburgh to Livingston is fifteen miles ; the road, as well as the adjacent fields, is strewed with fragments and blocks of basaltes. Six miles from Livingston, and in a place called Moorhead-craigs, we observed by the roadside a small peak of basaltes, having a tendency to divide into prisms, of which there already appeared a few groups, very distinctly formed.

Hearsthill is three miles distant from Moorhead-craigs. The traveller ought not to neglect visiting here a grand natural ball of basaltes, which lies on the west side of the road. Its shape is somewhat oval, and its greatest diameter is about five feet. The crust or exterior envelope, which is very hard,

hard, and quite sound, is three inches thick, and contains another solid ball equally sound, and of the same form. It is remarkable that the space between the solid ball and the hollow cover is well defined, and more than an inch wide. The covering appears completely detached from it on all sides; though they must necessarily touch at some points not exposed to view.

The same revolution which removed and transported to this place a ball of such bulk and weight, has so conveniently broken off a piece of the crust, that one might imagine it had been purposely detached to discover its interior structure.

That lucky accident, that contraction of the lava on all sides at the time of cooling, which produced this kind of volcanic geode, is worthy the attention of naturalists. It is with pleasure, therefore, that I point out the place where I observed that basaltic ball, which may be very easily found. It lies on a rising heath near Hearsthill, and six paces to the left of the road from Edinburgh to Glasgow.

This place presents another object, no less worthy of attention, and which well deserves

deserves to be profoundly examined by the naturalists of Edinburgh or Glasgow, who have it more in their power to inform us of those facts and details, which, to be fully developed, would require a pretty long continuance on the spot.

The lands of Hearsthill consist of a flat tract on an eminence; and this elevated plain is covered with blocks and fragments of compact lavas, which appear to have been carried thither by some convulsion of nature.

At a little distance from the basaltic ball, which I have mentioned, and in an opposite quarter, that is, to the left of the road, there are several small eminences, covered with a thick and mossy herb, which seems to rise out of a black and marshy earth; yet in this place there is neither marsh nor water.

Some of these elevated spots have been partly dug away; and one may there see with astonishment, 1st, a stratum, from two and a half to three feet thick, of good turf, which serves for the use of the circumjacent country; 2dly, large beds of clay, intermixed with masses of basaltes; 3dly, a mine
of

of coal, lying beneath the former substances, and opened by several pits, which are in full activity.

This is a curious fact in natural history, and is worthy of profound investigation. Had I known that I should have met with so remarkable an object for studious inquiry, I should have certainly made arrangements for stopping a few days at Hearsthill, to trace with that attention which such a subject requires, the disposition and order of the several substances, and to measure their strata. But as we had to reach Glasgow that evening, I had time only to remark its situation. What I have stated, therefore, is to be considered as no more than a simple notice of the place, and an invitation to naturalists to direct their attention to so interesting a phenomenon.

On our arrival at Glasgow, our first business was to deliver some letters of recommendation, which we brought with us from Edinburgh; and we then went to see such things as were most worthy of notice in the city. Natural history is not so much cultivated here as it is at Edinburgh; its commerce, which is very considerable, appearing

ing to absorb every other consideration. The university and printing-houses of Glasgow have, however, enjoyed a very high reputation, and it has produced several men of learning. We were told of a cabinet formed by Mr. Anderson in the university; we went to see it; but we found only a collection of the most common philosophical instruments, and a few minerals which were in general little interesting.

I was astonished, in a climate so cold and so humid as that of Glasgow, to see the greater part of the lower class of females, and even many of those in easy circumstances, walking about with their heads and feet bare, their bodies covered only with a jump, and a gown and petticoat of red stuff, which descended to the middle of their legs; and their fine long hair hanging down without any other ornament than a crooked comb to keep back that part which would otherwise fall over their faces. This garb of the females, simple as it may be, is not destitute of grace. As there is nothing to fetter their movements, they display an elegance and agility in their gait so much the more striking, as they are in general tall, well made,
and

and of a charming figure. They have a clear complexion, and very white teeth. It is not to be inferred, because they walk barefooted, that they are neglectful of cleanliness; for it appears that they wash frequently, and with equal facility, both their feet and their hands. In a word, the women of Glasgow will be always seen with pleasure by the lovers of simple nature. The children and young folks go also barefooted.

The vicinity of the mountains draws a great number of Highlanders to this city. Their antique vestments, very much resembling those of the Roman soldiers, form a remarkable contrast with the dress of the women and other inhabitants. I shall speak in another place of this extraordinary garb, which is derived from a very remote period.

In the environs of Glasgow there are considerable coal-mines of excellent quality. They make trade and manufactures prosper; and thereby increase the happiness of the inhabitants.

The coal is found under beds of quartzose freestone, which, in some mines, are more than one hundred and forty feet thick; it adheres to the freestone, without any intermedium.

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I endeavoured to discover impressions of fern or other plants in these mines. They are very rare; but after a careful examination of considerable heaps of substances brought up from the bottom of the mines, I observed, in a part of the freestone adhering to the coal, some very distinct portions of a large fern, which resembled the American fern.

Pieces, composed of ligneous fibres, are also found in a kind of coal which the miners, on account of its variegated and changeable appearance, call *parrot-coal*. This coal is not so bituminous as the common kind, stains the hand less, takes fire more easily, and burns with a very bright flame; but it is not so durable.

The freestone which covers the coal-mines of Glasgow, consists, in general, of large quartzose particles. At no great distance from the city, and near some coal-pits there is a very extensive open quarry of freestone. This excavation is very ancient, and considerable quantities of stone have been dug from it. The opening is, therefore, very large, and exposes to the eye a full view of the interior of that mass, to the depth of nearly eighty feet.

It

It is disposed in banks nearly in an horizontal direction, and more or less thick. But as the substance is entirely homogeneous, it cannot be known whether the lines of separation have been produced by successive deposits, or whether they are merely the effects of shrinking.

The coal begins to appear at the depth of thirty feet from the surface, in scattered lines, running in an irregular manner through the midst of the freestone. Then follow banks of the same stone, without the least vestige of coal. But as the beds descend, the coal reappears in small, straggling, and interrupted veins, from three to four inches thick. These are again succeeded by an unmixed mass of freestone, which falls through a depth of more than forty feet, and terminates in solid and continued beds of coal.

The quarry which I have mentioned did not admit of my tracing the order of the banks, and the disposition of the substances, beyond the depth of eighty feet. But having descended into one of the neighbouring pits, sunk through the same stone, I had an opportunity of making the above observations.

This statement may be of service to those
who,

who, from motives of public utility, are engaged in studying the theory of coal-mines, and are desirous of applying their knowledge to practice. The best coals, both in England and France, are such as are found under freestone.

Let us suppose, for instance, that experience had not already ascertained the disposition of the substances in the coal-mines of Glasgow, and that a pit were opened from above the freestone till the miners had reached the small straggling veins of coal;—if they should follow, by a lateral course, this first indication, it is evident that they would be misled. If, on the contrary, they should continue to sink the pit in a perpendicular line, they would discover a second indication, consisting of small veins, of a little more thickness than the first, though running also in an irregular manner. But as, in continuing to dig, they would have descended more than eighty feet, without meeting another indication, they might, at length, become disgusted, and abandon the richest mines, when on the very verge of reaching them, by penetrating a few feet farther.

It is my opinion, that if it were possible

to procure topographical plans, executed according to drawings taken from nature, by men of competent experience, and exhibiting sections of the most valuable and best known mines, it would greatly tend to the advancement of that useful art, and would, at the same time, throw light on the natural history of the subterraneous world.

The environs of Glasgow present a fertile field of observation, by assemblages of pitcoal, freestone, calcareous stones, and volcanic productions, within very short distances of each other. The lavas, however, occupy the higher parts of the soil; and they present such interesting varieties, that the greatest part of the time which I spent at Glasgow was employed in studying them with attention, and in taking notes of those objects which appeared most proper for enlarging that branch of natural history.

The volcanic zone, which comes from a distance, seems to be interrupted here. It was on our way out of the city, by the side of a water-mill, called the *Town Mill*, or more properly in the channel of the stream which turns it, that we observed the first products of a grand subterraneous combustion.

As

As cultivation, however, in the environs of a city, must have naturally changed the face of the soil, it is proper to recollect that cleared grounds, pasturages, and gardens, never permit us to see it in its primitive state. But as this place presents deep hollows and naked summits, inaccessible to cultivation, it is to these original objects that the traveller should direct his principal attention, because they are the most striking and least doubtful in their appearances; and, because they gradually conduct him to the foot of some steep, craggy rocks, where quarries of lava have been opened, which yield excellent stones for pavements. Near them are found various other kinds of lava, and volcanic currents of mud, to the formation of which water must have contributed as well as fire.

I pursued this course myself; and as the observations which I made may serve to direct the steps of naturalists a thousand times better informed than I am, I shall here transcribe my notes, in the same form as I wrote them, without any other pretension than that of faithfully pointing out the different objects which appeared most worthy of attention.

The first volcanic hill, where I found some

prisms of very pure basaltes, is situated at the extremity of a piece of water, near a bleach-field. The prisms are very large, and, though not of a perfect configuration, are tolerably well defined. This basaltes is extremely hard and black, of a very fine grain, and of a substance so completely fused, that neither schorl nor any other extraneous body can be distinguished in it. It strongly attracts the magnet, and emits sparks on being smartly struck with steel. Its constituent molecules are so intimately united to each other, that time and the severity of the climate have not injured in the least, either the faces of the prisms, which still preserve their hardness and colour, or the entire of the mass, which remains unaltered, and without any perceptible appearance of decay.

Passing thence to the opposite extremity of the same lake, that is, towards the end nearest the public road, which is itself carried along a continuation of the preceding hill, the compact lava is no longer that beautiful, pure, and black basaltes which I have just mentioned. It has much the same hardness; but it is intermixed with felt-spar of a greenish-grey colour, and a number of small
crystals

crystals of black schorl, in the form of striated needles, several of which are in a state of decomposition. This lava is strongly magnetic.

It is composed of small prisms of well defined triangular, quadrangular, and pentagonal forms. Many of these prisms appear of a sound and compact texture when broken, whilst others have their crusts impaired to a certain depth. This alteration is so much the more remarkable as it is progressive, and makes an uniform appearance on the different faces of the prisms. Thus, for example, if one of the unsound triangular prisms be broken equally and transversely with a smart blow of a hammer, on inspecting the fractured piece, it will be found that the decayed parts form a very exact triangular zone, spreading sometimes several inches into the interior of the prism, in such manner, that on removing all that has undergone alteration, the sound nucleus remaining will still retain the same triangular form. This sort of regular and symmetrical progression in the alteration of the respective faces of these prisms, deserved, in my opinion, to be mentioned here. It may interest those naturalists whose studies are principally

directed to the natural history of volcanic productions, and consequently to all the circumstances connected with their decomposition.

On descending to the foot of the craggy ridge, opposite to the town mill, and towards the tract watered by the stream which moves the mill, we saw a small quarry of granitic lava, which was intersected with several veins of calcareous spar, mixed with grains of quartz and martial pyrites. The lava itself also contained some pyritous spots, where it came in contact with the veins of calcareous spar. This mixture of calcareous spar and pyrites, which I had before remarked in lavas, almost always announces the vicinity of some crater, where the sulphuric acid, disengaged by the heat, rises in the form of elastic gas, combined with the aqueous fluid; whence there result decompositions and new aggregations, of which we should never have conjectured the origin, were it not for the striking instances afforded by the crater near Naples, where nature seems to operate, as it were, under our eyes.

I was recounting these instances to my fellow-tourists and observers, when William
Thornton,

Thornton, whose eye is as penetrating as his judgment, exclaimed: "What you tell us appears to me so true, that I think I see, at a little distance, some discoloured lavas, which may very probably present to us the remains of an ancient crater."

We repaired instantly to the spot, and discovered a large extent, where the black compact lava is not only altered in its colour and hardness, but is so entirely discoloured and earthified, that it might be taken for a white clay. A few schorls have resisted this decomposition, and are found unimpaired in the lava. Here, likewise, are seen all the different shades of the colouring principle, derived from iron, which, in its changes, has occasioned reddish tints, and all the various modifications producible by the grand agent of nature.

These discoloured lavas conducted us to other lavas in their vicinity, which had suffered less, but which presented other appearances worthy of remark. We found some granitic lavas in the shape of balls, several of which were two feet in diameter, while others were no larger than a swan's egg. As they have undergone different de-

degrees of alteration, they exfoliate, and separate in the form of strata; and, on being neatly broken into two, the nucleus appears sound and entire, in a covering of small foliated pieces of lava. Some of these balls are found in a detached state; but the greater part are implanted in the solid mass of lava.

But the most remarkable objects which I saw in the volcanised circle of the environs of Glasgow, were very distinct prisms of granitic lava, of different sizes, with well-shaped angles, leaning against each other, and, in general, of a quadrangular, pentagonal, or hexagonal form. These prisms have suffered a peculiar alteration, which has attacked the aggregation of their component parts, or rather, which has dissolved that union which constituted their hardness. Their angles are, consequently, worn away; and it is singular that, in proportion as the angles are defaced, the central and most solid part assumes the form of a ball; so that the round masses seem to emerge from the middle of the prisms. I once saw something of the same kind in the volcanos of Vivarais;

Vivarais; but the figures were not so strongly marked as here.

These preliminary and local observations have appeared to me necessary, to introduce a particular account of the volcanic objects which I collected in the environs of Glasgow. I made an interesting collection of these lavas, as well as of their principal varieties, to be sent to France. But as it was possible that some accident might befall them before reaching their place of destination, I drew up, on the spot, a succinct catalogue of them, arranged according to the numbers which I pasted on each article. I shall, at least, preserve, in case of any mischance, the remembrance of a number of objects which strongly interested me; and by those means, I may put naturalists in the way of prosecuting the same inquiries, and of giving a greater interest and expansion to their labours.*

* It will be seen in the sequel, that this apprehension for the fate of my collections was not groundless. I, therefore, allow the minute of the specimens, which I collected at Glasgow, to keep its place here.

VOLCANIC

VOLCANIC PRODUCTIONS OF THE
ENVIRONS OF GLASGOW.

BASALTIC LAVAS.

No. 1. A triangular prism of basaltic lava, black, hard, and magnetic.

No. 2. Prismatic quadrangular basaltes ; part of which is a compact, black, hard, and magnetic lava, and of a homogeneous paste, unmixed with any extraneous body, whilst the other part of the same prism consists of a compact porphyric lava, of a blackish bottom, and interlarded with small irregular crystals of black schorl and reddish felt-spar. This prism, which is only eight inches long, and two and a half inches broad, is the more curious, as it is a specimen of a lava, the primitive matter of which seems to have belonged to a rock of trapp having a porphyric base ; since a portion of this remarkable prism bears the marks of porphyry, and another those of trapp. I had before remarked in original rocks the conversion of trapp into porphyry by the addition of felt-spar ; but it requires a very happy concurrence of circumstances to discover the same appearance in a compact lava of the prismatic form ;

form; and, under this point of view, this beautiful specimen is worthy of remark.

No. 3. Pentagonal prismatic basalt, of the most perfect regularity in its five sides; pure, black, hard, and attractive of the magnet.

No. 4. Slabbed basalt; black, hard, magnetic, of a very fine grain; and with a few points of black schorl distinguishable in its texture.

No. 5. Black compact lava; the colour of which has been impaired by the action of some elastic gas, or rather by that of an aqueous fluid, loaded with some principle, which, by attacking the ferrugineous particles of this lava, has destroyed their attraction for the magnet. This specimen is remarkable by its adherence to a small bottom of calcareous stone. I picked it up near the rock which skirts the stream of the town mill.

No. 6. Basaltic lava, which has lost its colour, and become white, preserving, however, a portion of its hardness, and especially its rough and dry grain.

No. 7. Another compact basaltic lava, so altered, that its substance is not only very white, but likewise soft and tender to the touch,

touch, like clay. Some small prisms, however, have still preserved their form.

GRANITIC, OR PORPHYRIC, LAVAS.

No. 8. A triangular prism, composed of a lava, the black texture of which is somewhat scaly, and intermixed with irregular lamellated grains and pieces of reddish felspar, and a few small dots of quartz. This lava, which is strongly magnetic, seems to have for its basis a black trapp, composed of scaly particles, or more properly, a hornblend, or rock, schorl; its fracture appears solid and sound, and it is susceptible of a fine polish.

No. 9. Another triangular prism, of a deep iron-grey colour, having its texture intermixed with a number of small parallelopedal white glittering crystals of felspar, and with small irregular plates of the same matter, and of a similar lustre and colour. This prism, which is of a regular, well-defined form, has suffered an alteration in its exterior parts to the depth of three lines. But this alteration has nowise defaced it; the colour is changed, and the surface may be more easily cut through, but it remains very hard

hard in the centre. The change of the particles has proceeded so equally and uniformly on all sides of the prism, that the colour which it has produced touches that of the unaltered part in right lines; so as, on viewing the prism at one end, to exhibit the appearance of one triangle inclosed in another, of a different colour. The sound part is magnetic; the altered part is not.

No. 10. Granitic lava of a black basis, mixed with a great number of small crystals of yellowish felt-spar. One of the faces of this specimen is covered with a layer of calcareous spar, of a rosy colour, and also with a thin stratum of white quartz, which forms a transparent varnish above the calcareous spar.

No. 11. The same lava with No. 10, intermixed with a few pyritous specks, and having a layer of white calcareous spar on one of its faces.

No. 12. The same lava, blended with a number of sharp points of black schorl.

No. 13. Granitic lava, which seems to consist of a yellowish-white felt-spar, and black pointed schorl: these two substances appeared to enter in equal proportions.

No. 14.

No. 14. The same lava as the above; but containing a greater proportion of black schorl than of felt-spar. The schorl is formed into long prickles of a shining appearance, but somewhat defaced by the action of fire. It attracts the magnet.

No. 15. Compact granitic lava, of a greenish colour, with some crystals of felt-spar and laminæ of mica. This lava acts very powerfully on the loadstone.

No. 16. Lava of the variety, No. 10, containing some crystals of garnet, of twenty-four trapezoidal faces, of a greenish-grey colour, and very much resembling those found on Vesuvius. This is the first time that I have seen this kind of garnet in any other lava than those of Vesuvius. I have never met with it in the volcanic products of Ætna, of the Isle of Bourbon or Iceland, nor in those of Auvergne, Vivarais, Velay, the banks of the Rhine, &c. I found near Glasgow only two specimens of the lava containing these garnets; M. de Mecies picked up a third. The crystals are in the most perfect preservation.

No. 17. Prismatic porphyric lava, in which there is a great proportion of dull white felt-spar,

spar, and black pointed schorl. The schorl has lost its lustre, and the basis of the lava is changed into an ochrous, friable, and tender substance, which may be bored and even cut with ease. But the lava, notwithstanding its advanced state of decomposition, is strongly attractive of the magnet. This may be owing to the schorl, which is not so much altered.

No. 18. A round ball of porphyric lava, formed into concentric layers by decomposition. Some balls of this kind had as many as seven layers, which were exfoliated, and could be easily detached from each other; whilst the part which had undergone no alteration, and which formed the nucleus, was of a compact, hard texture, and had no appearance of being stratified.

Such are the volcanic products which I collected in the environs of Glasgow, during the three days that I spent in these researches without information or conductor. I should wish to have been able to devote a longer space to this employment, which strongly excited my curiosity; but it is more than sufficient to put others in the way of perfecting the feeble outline which I have sketched.

sketched. I ought not to omit mentioning, that I found on the highest of the hills in the vicinity of Glasgow, among some rounded lavas, several blocks of a quartzose stone intermixed with mica, and containing some twelve-sided garnets, of a somewhat coarse texture, but of a very regular configuration. These blocks of micaceous quartz, which are found dispersed in different directions, have been forcibly carried along with the lavas, by the effect of some convulsion. But as they are of considerable bulk, and as it is consequently probable that they have not been transported from a very great distance, they may afford some indications of the primordial rocks from which they have been torn by a volcanic explosion.

It would be nowise surprising to find that they have been discharged from a very considerable depth. Vesuvius affords instances of particular stones, which it throws out in some of its eruptions, that have no resemblance to any substance found in its environs, nor within a great distance of it. The quartzose stones intermixed with garnets here mentioned, may be supposed to have had a similar origin, if there should not be discovered

discovered in the vicinity of Glasgow, or within a considerable length of it, any rocks of which they might have formed a part.

Here I ought to state a difficulty which I experienced in my examination of those lavas of the environs of Glasgow, which I have termed granitic and porphyric lavas.

These lavas undoubtedly consist in some cases of the former, and in others of the latter of these compound stones; and there were instances in which I could make the distinction, without any apprehension of being deceived, when their characteristic differences were apparent. But as the long-continued action of fire, with that of various emanations of gas, have altered and often destroyed the constituent principles of these lavas, preserving, however, some characters common to granites, and porphyries, such as crystals of felt-spar or schorl, I must have necessarily laboured under considerable embarrassment and uncertainty. As the basis, however, of ordinary porphyries is composed of those particles which constitute trapp, or hornstone, and as this basis readily enters into fusion, it may be distinguished with a little practice. But when the emanations

have acted on this basis, and destroyed its cohesion, and when the same cause has produced the same effect on the granites, the case becomes much more difficult and embarrassing. I have probably, however, said too much upon a subject which can interest only one class of readers.

Our harvest in natural history being finished in this quarter, we made preparations for our departure for the Highlands; and as no relays could be got on the Inverary road, we hired horses and drivers to be kept during the remainder of our journey.

I forgot to mention that we brought a draughtsman with us from Edinburgh, to take such views as should appear to us the most important towards the advancement of the natural history of volcanos in that part of the Hebrides which we intended to visit.

CHAPTER X.

Departure from Glasgow.—Dumbarton.—Volcanic Substances.—Loch-Lomond.—Luss.—Tarbet.—Loch-Fhynes.—Inverary.—Inverary Castle.—Its Parks and Gardens.—Natural History.—Departure from Inverary.

ON the afternoon of the 14th of September we left Glasgow for Dumbarton, where we had resolved to sleep that night. When we arrived, we found there was a fair in the town, which made it extremely difficult to procure beds in the inns, as they were full of strangers. Here the traveller must bid adieu to all traces of the English neatness: he meets with very different manners and customs; but he who is in search of information easily accommodates himself to every thing. The barley and oats were not yet ripe, so little advanced was the harvest at Dumbarton.

This little town stands upon an arm
Q 2 of

of the sea into which the Clyde, which flows past Glasgow, falls. It is defended by a small fort, built upon a steep volcanic and solitary precipice, which has two summits. I know not why Mr. Pennant, in speaking of the rock on which Dumbarton castle stands, should say that its height is stupendous. I found that it did not exceed two hundred and fifty feet.

It is formed of a blackish basaltic lava, which is hard, magnetic, and of a fine grain. This lava has, in general, a tendency to a prismatic form; but, with the exception of some small prisms, which are occasionally to be found, the principal masses present sketches only of pillars.

The only part of the hill which deserves the particular attention of naturalists is that which fronts the town. There will be found in it:

1. A current of muddy lavas, which includes a number of fragments of basaltes, more or less altered: this current is crossed by some veins of calcareous spar, a work of infiltration.

2. In the same current there may also be observed

observed a small quartzose zone, of a dull white colour, mixed with rose-coloured calcareous spar.

3. A thick vein of dark argillaceous schistus, which breaks into plates.

I believe that these last substances are still in their primitive place, and have escaped the action of the lavas which appear in the midst of them. They may be considered as testimonies that volcanoes have here exercised all their fury upon schistous rocks, somewhat mixed with mica, and crossed in some places by girdles of quartz.

In our excursions round Dumbarton, we saw immense collections of basaltes reduced into fragments. These hard black lavas thus broken, and heaped one above another, form little hills. It is really astonishing to see such great accumulations of lavas in fragments, particularly as they appear at about a mile from Dumbarton, on the road to Glasgow, where they form a vast causeway, which joins at a distance to more elevated hills.

We were told that these were remains of a wall of astonishing magnitude, which the Romans were obliged to erect in the time of Agricola, to secure themselves against

the incursions of the invincible Caledonians, whom these conquerors of the world were never able to subdue.

I know that ancient authors speak of this famous wall, and state that it was repaired by order of the emperor Adrian, upon which account it has been called *Vallum Adriani*; but according to them this was not its situation *. It is, however, true that Lollius Urbicus, Adrian's lieutenant, passed the wall of Agricola, and drove the Caledonians beyond the Clyde, where he formed a chain of fortifications †. Dumbarton is very near the Clyde, and the Roman wall, which tradition places here, was probably erected by Lollius.

It is not surprising that the Romans should take advantage of a position so favourable for erecting redoubts, which must have been very easily constructed, since nature has defrayed the principal part of the expence, by furnishing innumerable materials, accumulated by the active force of volcanoes, and forming themselves into a formidable barrier,

* The best maps delineate this line of circumvallation from Newcastle to Carlisle.

† Capitolin in Antonin.

I employed

I employed more than two hours in examining this kind of natural causeway, in which I observed only basaltic hills, reduced into fragments, without being able to discover the smallest work of art. It is possible, however, that military works may have existed here; and, perhaps, the Romans had constructed the redoubts of dry stone, without mortar. It is not surprising that all traces of them are now effaced, since works of the same kind formed during the wars of Lewis XIV. can now scarcely be distinguished.

In the excursion which I made to the distance of two miles round Dumbarton, my collection was confined to basaltic lavas, containing some globules of calcareous spar, and a lava of a muddy nature, to which there was attached a fine piece of zeolite, of a colour inclining to green.

There is also not far from the town freestone, in its primitive situation, of a red colour, and which appears to have been touched by fire. This discovers the ferruginous principle with which it is coloured.

We left Dumbarton at five o'clock in the evening, intending to sleep at Luss, on the
Q 4 banks

banks of Loch-Lomond, as we wished to have an opportunity next morning of examining at our ease that beautiful lake, and its little islands, which are about twenty in number, and on several of which there are some charming habitations. This is a fresh-water lake, and the largest in Scotland. It is twenty-eight miles in length, and is regarded as one of the wonders of the country.

We found that the volcanic substances disappeared, as we approached the lake. They were at first succeeded by calcareous stones, afterwards by granitic schistus, and by micaceous *kneifs*. But we had scarcely proceeded a mile on the banks of the lake when night came on, and deprived us of the prospect: we saw only a few islands, which appeared very picturesque. It was ten o'clock when we arrived at Luss. This place being marked on the map, I expected that it was a village, or at least a hamlet. It was, however, only one house, and such a miserable habitation, that I believed I was entering into a fishing hut: but our astonishment was great indeed, upon observing that signs were made us not to speak, which
seemed

seemed to signify that there was a person sleeping, whose repose we ought not to disturb. We believed there was some person very much indisposed in the house, for this was what the expressive gestures of the mistress and three servants seemed to announce. We therefore did not venture to open our mouths, but what we wanted seemed to be understood : we were, however, conducted, or rather driven, into a kind of stable, where we received an audience ; indeed, it was not a long one. *The justiciary lords, said the hostess, do me the honour to lodge here when they are on this circuit. There is one of them here at present. He is asleep, and nobody must disturb him. His horses are in the stable ; so you see there is no room for yours, and it is needless for you to stay.—But mistress,* said one of our drivers, *for we durst not venture to speak, look at our poor horses, and consider this terrible rain, —How can I help it,* replied she. We went off, and she shut the door after us, and double-locked it ; but first called out to us, *Make no noise : his lordship must not be disturbed. Every body should pay respect to the law. God bless you—farewel.*

We

We could not avoid laughing at this laconic kind of eloquence, which admitted of no reply, and this singular mode of shewing respect for a judge. We were, however, obliged to proceed on our journey, feeling much more for our poor drivers, and the horses, than we did for ourselves.

Unluckily we had still to travel fifteen miles in a dark and stormy night, along the banks of the lake, before we could meet any habitation. Never in my life did I make so disagreeable a journey, nor one which appeared so long.

Our horses, though good, were fatigued, and with difficulty carried us forward. Our drivers wished all the judges in Scotland a hundred times to the devil, and lavished a hundred curses on the landlady of Lufs. We endeavoured to console them in the best manner we could, by promising them a recompence, which indeed they justly earned; for they were wet to the skin, with a cold rain. At last we got to the end of our tedious and painful journey, arriving at half past three in the morning at a place called Tarbet, which was also a single house.

The people of the house rose very readily

dily at the call of our postillions, and our horses were put into a stable. Fortunately there was no judge here, but there were jurymen on their way to Inverary, who, having arrived before us, occupied all the beds by the right of priority. We were, however, happy that our horses were sheltered. We were kindly received, got something to eat, and some excellent tea, which greatly refreshed us.

The easy manner in which we put up with our bad accommodation interested the landlady; and when she learned that we intended to pass the remainder of the night in our carriages, she kindly offered us two mattresses from her own bed, observing, that she had had enough of sleep, and would not go to bed again. We thankfully accepted them. Count Andreani preferred sleeping in his carriage. M. de Mecies had one mattress to himself, and Thornton and I shared the other. We slept there three hours wrapped up in plaids, and our fatigue was removed.

A fine day succeeded to this dismal night. The sun was brilliant and warm; the sky a fine azure. We breathed the purest air on
the

the banks of Loch-Lomond, and saluted the nymph who presides over its beautiful waters.

From this point of view the appearance of the lake is truly superb, though only a part of it can be seen, on account of its great extent. It is interspersed with little islands, several of which are only barren rocks, but others are cultivated, and the woods and hills are grouped in a very picturesque manner. Our glasses enabled us to see some larger islands in the distance.

The banks of that part of the lake which was near us were composed of micaceous schistus, the lamellæ of which appeared in the shape of rods, undulating and shining as if silvered. A great variety of mosses, in flower, formed verdant caves in the hollows of the rocks, while the more elevated parts exhibited a fine pasturage, and were covered with black cattle and sheep. The shepherds, seated under large firs, and easily distinguished by the variegated colours of their Tartan dress, gave life to this magnificent rural scene, where peace and tranquillity seemed to reign. This beautiful prospect forms a fine contrast with the ordinary

dinary aspect of the mountains of Scotland, which is rendered so severe by the sombre colour of the heath, and by the characteristics of ancient volcanoes in those places where lavas abound.

We now regretted much that we did not find beds at Luss, where we might have embarked on the lake, visited some of the islands, and arrived at Tarbet by water; but we had no more time to spare for an excursion of this kind. It was necessary that we should proceed on our journey. After walking about for an hour and a half, we returned to our inn, where a breakfast of tea was prepared for us and in laying out which our hostess had displayed a little hospitable vanity. She had arranged here china on a neat little varnished tea-table, which was covered with every thing requisite for an elegant country breakfast. This good woman, who was a widow, possessed all the simplicity of manners, sensibility and gratitude, which distinguish the inhabitants of the Caledonian mountains. She informed us that she set more value on this little equipage than all the rest of her furniture, since she had received it from the duchess of Argyle, who

who stopped at this inn on her way to Inverary. She praised highly the goodness and generosity of this noble lady, and gave us a long history and eulogium of her ancient family.

Persons of fortune can easily make themselves beloved, and render others happy, at a small expence. Why then is this conduct so seldom adopted? Because it is more the offspring of nature than education; and the ruling inclination every where governs men. From the stories this good woman told us of the house of Argyle, and the tone in which they were delivered, I was convinced that this family is naturally good, distinguished by excellent qualities, and that in whatever situation fortune had placed them, they would have displayed the same amiable character. Philosophy has not sufficiently studied the passions with regard to nature. Though every thing cannot be ascribed to them, they certainly have a very powerful influence in the formation of human character.

The magnificent scenery of Loch Lomond, the fine sun that gilded its waters, the silvered rocks that skirted its banks, the flowery

flowery and verdant moss, the black oxen, the white sheep, the perfume of the tea, given with kindness, and received with gratitude, will never be effaced from my memory, and I shall ever cherish the desire of revisiting Tarbet before I die. Even among the oranges, the myrtles, the laurels, and the jessamins of Italy, I should often meditate on the wild and romantic beauties of Loch-Lomond.

But let us proceed upon our journey. I soon found a contrast to the delightful scenes we left. They were succeeded by dismal heaths. We entered a narrow pass between two chains of high mountains, which appear to have, at a very remote period, formed only one ridge, but which some terrible convulsion had torn asunder throughout its length.

This defile is so strait, and the mountains are so high and steep, that the rays of the sun scarcely penetrate it. Indeed, the sun is here only seen for the space of an hour in the twenty-four. For more than ten miles, which is the length of this pass, there is neither house nor cottage, and not an animated being to be seen, except a few fishes in a small lake, about half way. I do not mention

mention the flocks of sheep or goats that feed on the mountains, because they are at so great an elevation, that neither their shape nor their motion can be distinguished; and they appear more like round stones than living animals. It is impossible to tell what they are by the naked eye.

We were nearly six hours in this dismal passage, the road through which is almost impassable; at last it suddenly opened on Loch-Fyne, in Argyleshire. The first village we arrived at was Cairndow, on the extremity of the lake. We went round this point of the lake, and arrived at Inverary, the capital of Argyleshire. Though this be the chief town of the county, it would only be called a village in France; but it is charmingly situated upon the side of the beautiful Loch-Fyne, which may be navigated by large vessels. This lake also abounds with herring; and the fishery, which annually takes place upon it, employs a great number of vessels, and yields a considerable revenue. Here there is the view of some pasture-grounds and trees in a valley, which terminates in a fine park, skirted by variegated gardens, meadows covered with

with flocks, and hills planted with green trees. At the bottom of this landscape stands a magnificent habitation, in the Gothic stile. It is Inverary castle, the residence of the Duke of Argyle.

It was from the door of the only inn in the village we enjoyed this fine prospect. Our carriages were already within the yard, when the master came out, and very politely informed us, that we could not be received, as every room in his house was either engaged, or already occupied. The judge who had disappointed us at Luss was, it seems, expected here, and the best room was very properly reserved for him: the jurymen were in possession of the rest of the house.

We had letters of recommendation to the Duke of Argyle, and we understood that he had arrived at Inverary, where he intended to pass the autumn; but we did not choose to wait upon him until we had procured lodgings for ourselves, as we should have been sorry to abuse any kindness that might be shewn us.

The inflexibility of the innkeeper, however, embarrassed us greatly. He would not

receive our baggage, nor allow us to enter his house. Our only alternative was to proceed to Dalmally, about fifteen miles from Inverary; but it was already too late for undertaking a journey, which would have obliged us to travel through very bad roads, during the night. Besides, we should have lost the opportunity of seeing the Duke of Argyle, delivering our letters, and receiving from him information respecting the country, and the difficult route we had still to pursue before we could arrive at Oban.

These considerations induced us to ask the innkeeper, if he would permit us to step into a room, and write a letter to the Duke of Argyle. The name of his grace is here held in the greatest veneration; and we had no sooner mentioned it, than every thing we asked for was granted. In presenting our respects to the Duke, we stated our situation, and, at the same time, expressed our reluctance to give him any trouble on that account. To this billet we joined our letters of recommendation, and an express was instantly dispatched with the packet. We soon received an answer, by a French painter, who, at this time, was employed in Inverary

Inverary castle. He informed us, that we were anxiously expected at the castle, and begged us to come just as we were, as the family would not sit down to dinner till we arrived. Servants were, at the same time, sent to take care of our carriages.

On our way to the castle, we saw the Duke's eldest son, who came to meet us with all the demonstrations of the most engaging politeness and generous affability. When we arrived at the house, we were received with every mark of friendship by this amiable family, who, to the accomplishments that belong to their high rank, join all those finer qualities that spring from the feeling hearts and elevated minds, which the *truly well-born* only possess. After the first compliments, we placed ourselves at the dinner-table. Every thing pleased and interested me in this house, in which, if I may use the expression, there seemed to reign a fine kind of sympathy, that every where diffused happiness. I said to myself—*The good woman of Tarbet has not deceived me—This is a charming family.* French was spoken at this table with as much purity as in the most polished circles of Paris. They did not fail to en-

quire the motives of our journey to a place so little frequented by strangers as this distant part of Scotland; but their surprize soon ceased, when we informed them, that we intended to go to the Isle of Staffa, and visit the far-famed cave of Fingal.

If I recollect right, the Duke informed us, that Sir William Hamilton, and his nephew, Lord Greville, had undertaken the same journey, without having found a day favourable for the short passage between the main land and Staffa. As this craggy island has neither port nor road, and can only be approached by small boats, a calm sea, and the prospect of a continuance of fair weather, are absolutely necessary, before an attempt be made to visit it. These, however, seldom occur upon this coast, which is strewn with islands, washed by a variety of currents, and exposed to the most impetuous winds.

To shorten the passage by sea, we were advised to proceed from Oban up the Sound of Mull to the island of that name: to cross the island to Torolisk, where we should find the house of Mr. M'Lean, a very worthy gentleman, to whom the Duke of Argyle promised to give us letters of recommendation.

tion. From Torolisk to Staffa the passage is very short. We might go there and come back to the island of Mull in one day, by setting off early, and returning at night: but even for this little voyage it required one of those fine days which we had little reason to expect at a season already too far advanced: we were, however, told, that we might be fortunate enough to have some good weather even in autumn, and that to have arrived a little sooner, would have been no advantage to us, as the stormy period in these seas had commenced some months before.

The Duke of Argyle kindly said, that he wished to have the pleasure of detaining us with him for a few weeks, that we might have an opportunity of viewing the country, and examining such of the neighbouring mountains as were particularly worthy of observation. But, pressed for time, we could only promise to stay three days, which, if well employed, would, we thought, be sufficient to enable us to see every thing remarkable in the neighbourhood of Inverary, particularly some hills and quarries, which

appeared chiefly to deserve our attention. We therefore resolved to prosecute these studies early in the morning, and to employ the evening in that social intercourse, which would give us an opportunity of becoming more intimately acquainted with a family so hospitable, so well informed, and every way so amiable.

We remained, of course, three whole days in this delightful retreat, devoting the mornings to natural history, and the evenings to music and conversation. As the gentle and polished manners of the master and mistress of the house, as well as the excellent dispositions and promising talents of the younger part of the family, greatly interested me; and as I also saw here some of those customs which characterize the Scottish frankness and hospitality, I shall give a rapid sketch of my observations and remarks. They naturally ought to precede the account I have to give of the mineralogy of the environs of Inverary.

Inverary castle is entirely built of a grey-coloured *lapis ollaris*, soft to the touch, capable of receiving a fine polish, and every
form

form that the chisel can give: though delicate, it resists the weather, at least as well as the hardest marble.

One is at first sight surprised that a castle, in appearance so ancient, should exhibit no marks of decay: every thing is so well finished, the angles are so clean and so perfect, and the colour of the stone is so equal, that the building seems to have just come from the hand of the workman.

My astonishment on this subject, however, soon ceased, when, after crossing some draw-bridges, and passing through a gateway, the style of which was as Gothic as that of the age of Charlemagne, I arrived at a vestibule, which conducted me to an Italian staircase, with double balusters, and of the most perfect architecture.

This vestibule was ornamented with large bronze vases, of antique forms, placed on their pedestals, between the columns. These vases served, at the same time, as stoves to warm the vestibule and the staircase.

The whole of this part of the building is magnificent, richly decorated, and skilfully lighted. The steps are covered with elegant carpets, and every thing announces a refined

and exquisite taste. There appears, however, to have been a desire to exhibit even here some traces of the Gothic. To produce this effect, there is seen in the perspective of the staircase, a large niche, ornamented with Gothic columns, and which contains the case of an organ: this gives a solemn and religious air to the place. The contrast occasioned by this opposition of style may appear absurd in theory, but there is here a charm in the execution, which renders it very agreeable.

The other parts of the house are laid out in a manner equally elegant and commodious, and are capable of containing a numerous family. Throughout the whole, the luxury of simplicity, and the extreme of neatness, have, as they always ought in a country residence, been much more studied than the pomp of gildings, or sumptuous furniture.

Notwithstanding the antique appearance of this castle, it is really a modern building. A Gothic exterior, joined to an elegant distribution within, was preferred, because the buildings of the tenth century have a good effect in the midst of woods, and at the foot
of

of hills. They recal the chivalrous ideas which are connected with the bravery and gallant adventures of those romantic times. These recollections diffuse a sort of charm over the scene: they embellish it, and render it peculiarly interesting: there are few who do not find something pleasing in the age of romance.

The parks, in which native and foreign trees are intermixed, are very extensive, and have the finest effect: open spaces are left, covered with the most beautiful verdure, and roads and bye-ways are cut, which lead to gardens, green-houses, sheep-folds, and sequestered woods, on the sides of hills, the banks of rivulets, or towards the shore of an arm of the sea*.

The inhabitants of the castle, at this time, were:—the Duke of Argyle, one of the most amiable of men, and who had travelled in France and Italy:—his Duchess, who was formerly married to the Duke of Hamilton: she passes, and I believe justly, for having

* Knox, who was at Inverary two years after me, in speaking of that place, says: "Inverary has become of some importance, by the care of the family of Argyle, who have a magnificent house there, surrounded with more than a million of trees, which occupy several miles square."

been one of the finest women in Great Britain: she is certainly one of the best informed. — The Countess of Derby, the Duchess's daughter, by her first husband: this lady had travelled a great deal, and spoke French with so much facility and correctness, that she might have passed for a native of Paris: there are few women more beautiful, or more accomplished. — The children of the Duke. The eldest daughter played excellently on the piano-forte, and she, as well as her two younger sisters, was handsome and lovely. The Duke's son was, at this time, about sixteen or seventeen years of age, and already shewed much taste in drawing. A physician and a chaplain formed a part of the family establishment. There were also several visitors in the house, among whom was a member of parliament, a man of talents, who had travelled, with advantage, in every part of Europe.

I must not omit to mention, that on the second day after our arrival, the judge, on whose account we had been put to so much inconvenience, came to dine at Inverary castle. He was a good honest Scotsman, somewhat advanced in years, and he truly
deserved

deserved all the respect and attention that had been paid to him, for he exercised his office with justice and humanity. We made our peace with him in the manner of the country—in the midst of toasts; and he assured us, with great good-nature, that he would have shared his lodging with us, if he had known what passed, and that if he should have the pleasure of meeting us another time upon the road, he should not be the means of depriving us of beds.

The manner in which we spent our time at Inverary castle was extremely agreeable. Each person rose at any hour he pleased in the morning. Some took a ride, others went to the chace. I rose with the sun, and proceeded to examine the natural history of the environs.

At ten o'clock, a bell summoned us to breakfast: we then repaired to a large room, ornamented with historical pictures of the Argyle family; among which there were some by Battoni, Reynolds, and other eminent Italian and English painters. Here we found several breakfast tables, covered with tea, coffee, excellent cream, and every thing the appetite could desire, surrounded with
bouquets

bouquets of flowers, newspapers, and books. There were, besides, in this room, a billiard-table, a piano-forte, and other musical instruments.

After breakfast, some walked in the parks, others amused themselves with reading and music, or returned to their apartments. At half past four, the dinner bell was rung, and we went to the dining-room, where we always found a table of twenty-five or thirty covers. When all the company were seated, the chaplain, according to custom, made a short prayer, and blest the food, which was eat with pleasure. Indeed, the dinners were prepared by an excellent French cook, and every thing was served up in the Paris manner, except a few dishes in the English form, which made a variety, and thus gave the epicures of every country an opportunity of pleasing their palates.

I was particularly pleased to see napkins on the table, and forks of the same kind as those used in France. I am not much disposed to risk pricking my mouth or my tongue with those little sharp steel tridents which are generally used even in the best houses of England. I know that this kind

of

of forks are only intended for seizing and fixing the pieces of meat while they are cut, and that the English knives being rounded at the point, may answer for some of the purposes to which the French forks are applied, particularly in carrying meat to the mouth; but, I must confess, that I use their knives very awkwardly in this way. It is well, however, to accustom one's self to the usages of different countries; and it seemed to me that at table, as well as in several other instances, the English calculate more accurately than we do.

In England, the fork is always held in the left hand, and the knife in the right. The fork holds the meat down, the knife cuts it, and the pieces may be carried to the mouth with either. The motion is quick and precise. The manœuvres at an English dinner are founded upon the same principle as the Prussian discipline—Not a moment is lost.

In France, the first manœuvre is similar to that of the English; but when the meat is cut in pieces, the knife is laid down on the right side of the plate, and the fork is changed from the left to the right hand, with which it is lifted to the mouth: thus

our

our table tactics are more complex than the English, and require more time. The English method is certainly the best; but large knives, with rounded points, are necessary to put it in practice. And why not have them? There would then be an arm less in the hands of the vicious or the foolish.

How many frantic or hopeless beings have made use of sharp-pointed knives against themselves? How many monsters have cruelly used them against others? The melancholy list would, doubtless, be long; and, perhaps, if this useful instrument had not in Italy, Spain, and most other countries, the form of a filetto, such crimes would be less frequently committed. Experience has long since proved that great effects may spring from very trivial causes.

But howsoever this may be, I must not forget that the knives and forks at the Duke of Argyle's table served to help us to very good things. The different courses, and the after-meats, were all done as in France, and with the same variety and abundance. If the poultry was not so juicy as that of Paris, we were amply compensated by the most delicate moorfowl, by delicious fish,
and

and by vegetables, the quality of which did honour to the skill of the Scottish gardeners.

At the desert, the scene changed; cloth, napkins, and every thing disappeared. The mahogany table shone in all the lustre that wood is capable of receiving from art; but it was soon covered with brilliant decanters, filled with the most exquisite wines; comfits, in fine porcelain, or crystal, vases; and fruits of different kinds in beautiful baskets. Plates and glasses were distributed; and in every object elegance and conveniency seemed to rival each other. I was surprised, however, to see on the same table, in so cold a climate, and in the middle of the month of September, peaches, apricots, raisins, prunes, figs, &c. all of an excellent quality, except the figs, which could not be called fine, by a person born in the south of France. It is probable, however, that the greater part of these fruits were produced by much care and expence in hot-houses.

Towards the end of the desert, the ladies withdrew to a room destined for the tea-table: I was sorry that they left us so long alone; but the Duke of Argyle informed me, that he preserved this old custom in his family,

family, in order that the people of the country might not be offended by the breach of a practice, to which they had always been accustomed. The ceremony of toasts was well kept up in the absence of the ladies; but though they usually continued to go round for at least three quarters of an hour, no person's inclination was violated, and every one drank what he pleased. This, however, did not prevent a great number of healths being drank with spirit, and every demonstration of pleasure. Wines are the greatest luxury of the British table. They drink the best and the dearest that grow in France and Portugal. If the lively champagne should make its diuretic influence felt, the case is foreseen, and in the angles of the room the necessary convenience is to be found. This is applied to with so little ceremony, that the person who has occasion to use it, does not even interrupt his discourse during the operation. I suppose this is one of the reasons why the British ladies, who are exceedingly modest and reserved, always leave the company before the toasts begin.

At last they proceeded to the drawing-room,

room, where tea and coffee abound, and where the ladies did the honours of the table with much dignity and grace : the tea is always excellent, but it is not so with the coffee : since it was not good in a house like this, where no expence is spared, it cannot be expected to be good any where else in the country. I should imagine that the English and Scotch attach no importance to the fine perfume and flavour of good coffee ; for it seems to be all one to them what kind they drink, provided they have four or five cupfuls. Their coffee is always weak, bitter, and completely deprived of its aromatic odour. Thus they want an excellent beverage, which would be a thousand times more favourable to their health than tea. Kæmpfer, who resided long in Japan, and who has published some very curious observations upon tea and the shrub that bears it, remarks that it is of a narcotic nature.*

After

* " I observed," says Kæmpfer " that the tea leaves
" contain something narcotic, which occasions a disorder
" in the animal spirits, and makes those who drink them
" appear intoxicated : this bad quality is partially cor-
vol. i. S " rected

After tea, those who chused it retired to their apartments ; those who preferred conversation and music remained in the room ; others went out to walk. At ten o'clock supper was ready, and those attended it who pleased.

In England I always found that all classes of people eat a great deal more than the French. I do not know that they are more healthy ; indeed, I doubt they are not ; but this I know, that Dumoulin, one of the most celebrated physicians of Paris, once told me, that he was never raised in the night to visit any person who had not supped.

I have said that I rose with the sun to study the nature of the country, in excursions among the neighbouring hills. The following is an account of some banks of porphyry, which, with respect to their position, are truly worthy of fixing the attention of naturalists.—

“ rected by the operation of toasting the leaves, which is
“ repeated by degrees ; but it is never radically removed :
“ something capable of affecting the head always remains.”
Kämpfer's History of Japan.

BANKS

BANKS OF PORPHYRY ABOVE A BANK OF
LIMESTONE.

Near some lime-kilns, at the extremity of a park, and on the road which leads to Dalmally, there is a quarry in the side of an eminence, the working of which has laid the internal organization of the hill completely open. The disposition of its banks, and all the different materials which compose it, are perfectly disclosed.

A great quantity of stones have been taken out of this quarry, for building a mill at a short distance, and banking up the sides of a little river, which, after winding through the park, serves to turn the mill. This circumstance affords the greatest facility in observing the position and development of the materials of the quarry, and renders it an interesting object for study and meditation.

The superior part consists of a bed of vegetable earth, which, though not more than five inches deep, produces excellent herbage.

A bank of porphyry, of a reddish ground,

and about twelve feet thick, immediately succeeds the vegetable earth. This bank separates into three beds, of nearly equal dimensions, which in some places have formed curious rhomboidal contractions, while in others they are simply divided into irregular longitudinal cuts.

The mass of porphyry, twelve feet thick, rests upon a bed of tender and even earthy schistus, which is only two feet ten inches thick. The basis of this schistus is of a reddish-yellow colour. It is ferruginous, mixed with clay, micaceous, and soft to the touch. Though in a state of decomposition, it is, notwithstanding, magnetic. I only use the word schistus here in relation to the fissile disposition of this bed, which, perhaps, is only a detritus of porphyric matter.

This schistus, in its turn, covers a bank of limestone, of about seventeen feet thick, at a medium, which may be considered as a kind of white marble, and which is similar in its grain and texture to the marble which is called *saline*. This whiteness is not every where equal; for upon a very white ground there appear some parts of a whitish grain, covered with parallel lineaments, of a very deep

deep grey, which recal the idea of ribbands.

Of this marble, which is susceptible of a very fine polish, may be made chimney-pieces, and jambs of doors and windows. Its grain is scaly and saline, like the finest marble of Italy; but it is hard and rough to the touch. It is not, however, the less capable of receiving a lively lustre. It is entirely free from any foreign body, and were it not stained with some greyish stripes it would be one of the most beautiful marbles to be met with. It is applied to no other purpose than that of making lime.

When I said that this thick bank of marble succeeded immediately to the bed of micaceous clayey schistus, I should have added, that the superior part of the large calcareous bank is interspersed with small beds, or rather lineaments, of micaceous steatites, united with particles of marble. This does not affect its hardness, and renders it a kind of cipolin. But this mixture of steatites and mica penetrates only about an inch into the marble, which is afterwards perfectly pure. As to the position of the

banks, the latter form an obtuse angle towards the centre of the quarry; the left side of the quarry inclining considerably from the south to the north, and the right side, from the west to the east. According to every appearance, this position is the effect of some great convulsion.

Thus there is incontestably porphyry lying above limestone, modified into marble. The ground of this porphyry is reddish, with a number of crystals of felt-spar, of a dull white, and some crystals of black schorl, much larger, though less compact, than those of the red porphyry of the ancients, but in general very brilliant. The basis of the ancient porphyry is much harder than that of the porphyry of Inverary, which is somewhat earthy: but its basis is fusible, like that of the ancient. It is certainly in every respect real porphyry.

By these circumstances the quarry of Inverary is rendered very remarkable, and ought to be considered as an object well worthy of fixing the attention of all who have it in their power to visit it.

Time flies quickly away when passed in such good company, and spent in so agreeable

able a manner. It requires a considerable effort to leave persons whose natural affability is so engaging at first sight, and to whom our attachment increases in proportion as we know them better. Alas ! what is life but a series of continual privations ?—Let us add this to the many others we have experienced ; but let us learn to perpetuate our enjoyments by remembrance, and above all by gratitude. Let us leave this delightful mansion ; but never let us forget its worthy inhabitants.

CHAPTER XI.

Departure from Inverary.—Arrival at Dalmally.—Scotch Highlanders.—Their Dress.—Ancient Tombs.—Patrick Frazer.—Reception at the House of Mac-Nab, who possesses several Fragments of the Poems of Ossian.—Manner in which the Habitations of the Highlanders are warmed and lighted.—Their Usages.—The Circle, or Altar, of the Druids.

WE resumed our journey, at half past eight in the morning of the 17th of September, proceeding by the way of Dalmally. We soon experienced a striking contrast; for scarcely had we lost sight of the most charming of mansions, and the most amiable of hosts, when we entered into the midst of a chain of mountains of the wildest aspect,

The road is narrow, jagged with blocks of porphyry, and bordered in many places with banks of black schistus, cut perpendicularly.

dicularly. The gloomy appearance of this stone, intersected with large veins of white calcareous spar, seems to announce to passengers the mourning of nature in this frightful solitude.

This dreary and rugged way, where during eight hours we met with neither living creature, habitation, tree, nor verdure, is alike fatiguing to the body and the imagination. Our horses themselves, though fresh and well rested, appeared to be tired of it.

Often had I asked our guides whether this disagreeable road was near its end, when at last, about four in the evening, one of them shewed me a small column of smoke at a distance, telling me that was the place where we should sleep, and that we should reach it in half an hour. In a quarter of an hour after, indeed, we found ourselves released from the kind of close prison, in which we had been confined from eight in the morning.

A fine valley*, studded with cottages, suddenly opened to our view. A small river,

* Glenurchy. *Translator.*

called

called *Urchy*, winding along on the left, several houses in groups, and others scattered around, a church in the bottom, and a distant prospect of a lake, formed the embellishments of this landscape. The place where we stopped is called *Dalmally*.

The inn is conspicuously situated on a solitary eminence, covered with verdure. On our arrival, we saw about fifteen highlanders opposite to the entrance. All of them wore the same remarkable garb; and they saluted us in a very kind manner, accompanied, however, with an air of stateliness. We understood by their gestures that we were the subject of their discourse; for they spoke only in the Celtic language. But our host, who received us very handsomely, and who could speak a little English, said that we might make ourselves easy with respect to these men, who, being but little accustomed to see strangers in so retired a situation, where few passed, were fixing their attention upon us with pleasure.

“ You may assure yourselves,” said he, “ that these good highlanders, far from “ doing you any injury, would, on the contrary,

“ trary, think themselves happy to be able
“ to treat you according to the laws of hos-
“ pitality, which they have loved and re-
“ spected from the remotest period : this
“ is Sunday, which occasions so many to
“ meet together.”

We learned, in fact, that the Scotch highlanders are in general very zealous presbyterians, and such rigid observers of religious worship, as not to indulge themselves on that day in the most trifling amusement. They had just come from hearing sermon, and were resting themselves a little before retiring to their respective homes. Their grave and collected air formed a singular contrast with the gaiety and showy colours of their military garb.

Their dress is very remarkable. It consists in a military jacket, with sleeves and facings of a woollen stuff, in which the colours cross each other, so as to form large squares of red, green, blue, and white ; in a mantle of the same stuff, tucked up and pinned on the left shoulder, called the plaid; and in a kind of petticoat, short and plaited like the lower part of the military dress of the Romans. This last serves them instead of breeches ;

breeches ; but it does not descend much lower than the middle of the thigh. Their legs also are partly naked, being covered only with woollen half-stockings, of vivid colours, so disposed in cross-bars as to imitate very nearly the ancient buskin. Their head is covered with a blue bonnet, surrounded with a narrow variegated border, of red, blue, and green, and decorated with one long and waving plume. They generally carry a poniard, and frequently a pair of pistols, in their girdle ; this poniard bears the name of *durk* or *dirk*. Their shoes, which, in general, each makes for himself, in a coarse but stout manner, are tied with strings of leather ; this kind of shoes are known by the name of *brogues*.

They keep their money in a waist-belt of otter skin, which serves at the same time as an ornament. It is so formed that the skin of the animal's head hangs down before. The eyes are edged round with red woollen tape, and the whole is furnished with a number of small tassels of different colours. This skin covers a pouch, which serves them by way of purse.

Such is the attire which the Scotch highlanders,

landers, as well as the inhabitants of the Hebrides, have worn from a very remote antiquity.* Did they copy them from the Romans at the time when those lords of the world attempted in vain to conquer them; or have they received them by a more ancient derivation from their ancestors, the Celtic? This is a question of difficult solution.

It is, however, well known that the modern descendants of the ancient Caledonians are so attached to this form of vesture, which reminds them of their ancient valour and independence, that the English government found its repeated attempts to induce them to lay it aside, completely frustrated: though this dress is certainly the least adapted to a people who inhabit so cold and humid a climate.

After taking leave of our pious highlanders, we visited the place where we were

* According to Diodorus Siculus, the ancient Celtiberians also wore party-coloured garments. "*Vestibus utuntur mirificis, tunicas nempe tinctas, et variis coloribus floridas, quasi illi gestant Diodor.*" Sic. L. V. *Bibliot.* It should be remarked, that the Scotch highlanders and Hebridians still speak the Celtic, or Celtiberian language,

to lodge ; and its elegant appearance in so wild and unfrequented a situation astonished us. The threshold of the door, and the stairs, were scoured and strewed with fine shining sand ; the dining-room was covered with a carpet ; the beds were neat and good ; and the landlord was a worthy man.

We informed him of the object of our journey ; and as we were now only one day's travel from the place of embarkation, we asked him whether it was possible to procure us a guide well acquainted with the language of the country, and capable also of speaking a little English. “ Gentle-
“ men,” said our host, with an air of eagerness, “ I shall be able to accomplish
“ your wishes, and to procure you a per-
“ son versed in different languages, who will
“ act both as an interpreter and guide ;
“ having already visited several of the isles
“ which you intend going to see. He is
“ one of my best friends ; and nothing more
“ is requisite to be known, than whether
“ the employment in which he is engaged
“ will admit of his being absent.—I am go-
“ ing this instant to enquire.”

As he pronounced these words, he left

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us with an agility and vivacity, which astonished me, in a man of his age. I never met with a person of a more obliging and cheerful disposition, than this good Scotsman.

He came back a few minutes after, accompanied by a man of about twenty-eight years of age, of a mild and modest appearance, whom he presented to us under the name of Patrick Frazer, school-master of Dalmally. We soon formed our acquaintance with him. This man had prosecuted his studies with advantage, at the university of Edinburgh; he was well instructed in Greek and Latin, spoke English, and was completely master of his native language, the Celtic, which he regarded as one of the richest and most harmonious.

Patrick Frazer was passionately fond of the verses of Ossian; and often made excursions among the inhabitants of the mountains in quest of further fragments of those ancient poems. He had already procured as many as would form a considerable addition to the collection of M'Pherson, and continued to make frequent and happy discoveries

coveries in that respect, from the extreme pains which he took for that purpose.

The narrowness of his fortune necessitated him to exercise the humble occupation of a school-master.

The children of the place assembled in a kind of hut, constructed of stones, without any cement. Here the poor Patrick Fraser taught them to spell the Celtic, or Erse words, printed in the common character; for it would appear that the original characters of that language are lost.* I felt for

* Knox seems to have a different opinion; and as what he says on the subject is well worthy of attention, I extract the following passage from his book: "To these observations I shall add a few facts, to prove that we had for a long time back a written language. In the island of Mull, in the neighbourhood of Jona, there has been from time immemorial, till very lately, a succession of *Ollas*, or *Graduate Doctors*, in a family of the name of Maclean, whose writings, to the amount of a large chest full, were all wrote in Galic. What remained of this treasure, was not many years ago bought up as a literary curiosity, at the desire of the Duke of Chandois, and is said to have perished in the wreck of that nobleman's fortune.

"Lord Kaimes (Sketches, b. i.) mentions a Galic manuscript of the first four books of Fingal, which the translator of Ossian found in the isle of Skye, of as old a date as the year 1403. Just now I have in my possession

for the condition of this estimable and modest man ; but as I expressed my surprize and astonishment at seeing him reduced to follow such a vocation for subsistence—" I console myself," said he, mildly, " with my studies, and the desire of extending my information. It is true, that I sometimes feel uneasy, when I reflect that here I am destitute of every source of instruction. I should doubtless prefer living, though only on a little bread and water, in a city where I could find the means of gratifying my taste ;—but I must learn to accommodate myself to circumstances."

" sion a mutilated Treatise of Physic, and another of Anatomy, with part of a calendar, belonging probably to some ancient monastery, all in this language and character. These pieces, when compared with others of a later date, appear to be several centuries old. I had the use of another equally ancient, from Capt. M'Lauchlan, of the 55th regiment. It consisted of some poems, and a theological discourse. From these observations and facts, it clearly appears, that ever since the time of the Druids, the Galic has been always a written language." Knox's *Tour through the Highlands of Scotland*, &c.

It is to be regretted that Knox has not said something respecting the form of the characters which they used, and shewed what relation they bore to those of the Hebrew, Arabic, Greek, or Runic alphabets.

I should never have expected to meet with a philosopher of this nature, in such a place. A thousand times did I regret that it was not in my power to charge myself with the future fortunes of that singular and interesting man.

I stated to him our wish to receive information from him respecting the manners and usages of a country so familiar to him; and I asked whether he could do us the pleasure of accompanying us to the isles of Mull and Staffa.

“Most willingly,” said he, “but I ought first to obtain the consent of the parents of the children whom I instruct. It would be improper for me to request a longer space of absence than a week; to which, if they consent, I am at your command.”

We begged that he would do us the favour to sup with us; and as it was yet early in the evening, we requested he would go and speak with the principal inhabitants of the place, on the subject of the requisite permission. He took leave of us, and went to accomplish this object.

I profited

I profited by the remainder of the day, to make an excursion for the purposes of natural history, in the environs of Dalmally. I found that the stones which enter into the composition of the mountains here, are, in general, argillaceous schistus, intermixed with mica, of a greyish, or blackish colour, of a texture somewhat fibrous, and separating in leaves, more or less thick. The elements of this stone are pulverulent felt-spar, quartzose earth, clay, mica, and a small portion of iron.

I likewise examined the stones rolled down by the torrent of Urchy. They consist of blocks of granite, spathose rocky schorl of a black colour, and of compact lavas, of the nature of basaltes. All these stones are round, their angles being ground down with rolling along in the torrent, which carries them from a considerable distance.

I was drawn by a large smoke towards the declivity of a hill, where I presumed that some persons were burning lime. But as I had not yet perceived any calcareous substance here, and did not choose to deceive myself, to settle the matter I walked

to the place whence the smoke proceeded, though it was some way off.

I there found a lime-kiln at the foot of a quarry, worked perpendicularly out of the side of the hill. I attentively observed the order and disposition of the matters; of which the following is an account:

1st, The vicinity of the quarry, and, in general, all the surrounding hills are composed of micaceous fibrous schistus, which do not effervesce with acids.

2dly, The quarry is covered with a layer of quartzose sand, of a yellowish colour, three inches in thickness.

3dly, The sand is succeeded, particularly towards the left part of the quarry, as one views it in front, by very small strata of micaceous schistus, of the same nature with that of the neighbouring hills.

4thly, To these small beds of micaceous schistus adjoin two banks of calcareous stone, or more properly of calcareous spar, white, compact, hard, grained like salt, and intermixed with small laminæ of silvery mica, which stick in the calcareous body. Each of these calcareous banks is about four feet in thickness.

Thus,

Thus, in a space of fifteen miles, have I met with two instances, pretty much alike, of calcareous beds existing between rocks of a different nature : that of Inverary, where the calcareous strata, intermixed with mica, lie between banks of porphyry ; and this, where the calcareous stone is covered with micaceous schistus.

But it is important to observe, that in both quarries the calcareous matter is in the state of spar ; that is to say, it has undergone a confused crystallization, during which tumultuous and rapid operation, it has seized some particles, or rather small laminæ of mica. No vestige of marine bodies is ever found in these circumstances, as the calcareous matter is then in a sparry state, that is, held in a state of solution ; the first mode of its existence being effaced by the agitation and suspension of the particles in a fluid, which has occasioned a confused crystallization.

I do not, however, think that the opinion would be well founded, that this calcareous stone, which discovers no trace of any organic substance, is the product of an original earth, formed by nature, without

the concurrence of shells, madrepores, or other marine bodies. For how can we be certain that the calcareous strata here mentioned, have not been produced at a more early period by the animals of the ancient ocean, of whom the matter then bore distinctive traces, which have been subsequently effaced by solution, change of place, and secondary crystallization.

We see every day instances of new aggregations, destructive of the primitive forms. The grottos of Antiparos, of Our Lady of Balma, and several others, exist in the midst of calcareous rocks of shells.

The droppings which daily fall from the roof of subterraneous caverns, produce considerable masses of stalactites towards the top of the vaults, and of stalagmites on the sides, or towards the bottom. Would one be authorised, on examining some tables of these stalagmites, or calcarious alabasters, susceptible of so fine a polish, and of a semi-transparency, so agreeable to the eye, to pronounce that, as they exhibit no vestige of an organic body, these secondary stones are the products of a primitive calcareous matter, that is, of a matter which came
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out of the hands of nature in its present form? As if it were allowable in good logic to break the thread of analogies; as if a series of analogical facts did not at least amount to probabilities; as if the expressions, primitive mountains, original calcareous matter, were any thing else than unintelligible abstractions, when we observe visible and palpable agents which produce, and even assimilate themselves to the calcareous matter in organic forms. These forms are so many distinguishing marks, and interesting indications, proper to direct us in the painful and difficult path of the history of the revolutions of the earth.— Upon all occasions then, when we see them, effaced, in circumstances where the matter, losing its organic form, is modified into spar, alabaster, stalactites, saline marble, or gypsum; I do not conceive that we are justified in pronouncing decisively that it has not been produced by organic bodies, or that it has never passed through animal filters. It is the same with the mountains denominated primitive; with those of granite, for example, which are formed by the aggregation of several substances of dif-

ferent origin, that necessarily suppose an existence anterior to that of their aggregation, in the forms of felt-spar, mica, schorl, quartzose, calcareous, and sometimes ferruginous particles. But I shall proceed no farther, as this is not a place to enter into the discussion of these great and important questions.

As the day was now drawing to a close, I was obliged to suspend my researches, and to rejoin my companions at the inn. There I found Patrick Fraser, who told me that he was at our service, and that he had permission to remain ten days with us. This information gave us very great pleasure.

We sat down to table. Our supper consisted of two dishes of fine game, the one heathcock, the other woodcock, cream, fresh butter, highland cheese, a pot of preserved *vaccinium* (bilberries), a wild fruit which grows on the mountains, and port wine. They were all served up together, and formed a truly luxurious repast for the country.

Our host, who was naturally polite, and who besides took us for some great personages, on seeing us arrive with three carriages

riages and four domestics, insisted, notwithstanding our objections, on paying us all the honours which he was accustomed to shew the Scotch *lairds*. He accordingly took his station behind one of us, in order to receive and execute our orders. Wishing to place him on a more friendly footing, we begged that he would take a seat at table with us. This, however, he refused; nor would he consent to accept of any thing but a single glass of wine to drink our health. After supper he brought us some excellent rum and tea, of which we had much need, to refresh our spirits. Of these he consented to partake with us, and we spent the remainder of the evening in an agreeable conversation with that good-hearted man, who gave us some interesting communications respecting the manners and usages of the country.

This innkeeper was in easy circumstances, and his children, who were very numerous, were educated with great care. Patrick Frazer served as their tutor, and a writing, and also a dancing master came every year from a distance to spend some months at his

his house, exclusively occupied in giving them lessons.*

At sunrise of the next day, I went to visit the church, which had attracted my attention, the preceding evening, by the number of tombstones which I saw in an adjoining field.

This country church is a modern fabric ; and its ruinous condition, both without and within, strongly proclaims the poverty of the inhabitants of the place.

But a vast number of tombs, and some levelled ruins at a little distance from the church, indicate that there formerly stood on that spot some very ancient religious monuments, which have been destroyed probably at a remote period : for if fanaticism had displayed itself here, in its usual manner, at the epoch of the reformation, we should have found more considerable remains of buildings, nor would so many tombs

“ A commodious inn at this place,” says Knox, “ is rented at 6*l.* and the window tax amounts to 4*l.* 10*s.* “ This disproportion arises from the well-judged munificence of the proprietor, who thus almost at his own expence, accommodates travellers with decent lodgings.”

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have been respected at a time when nothing was respected.

The style of the workmanship of the most ancient of these tombs was so remarkable, and uncommon, that I resolved, for my own instruction, to examine them very carefully.

All of them are constructed of *lapis ollaris*, or coarse serpentine stone, of a deep grey colour, nearly resembling that of which the Castle of Inverary is built. This stone has completely resisted the impressions of the weather, and the tombs, which appear the most ancient, are in a most excellent state of preservation.

Their form is that of a simple sepulchral stone, somewhat narrower towards the bottom than the top, in the manner of a coffin. But I know not whether they have always been in their present state, or whether they have not formerly served as covers to hollow tombs, such as those of the Romans generally were.

Several are cut into right angled parallelograms. Some are five feet eight inches, while others, which are the most numerous, are only five feet three inches in length. I found

found one which measured only three feet and a half in length, and eight inches in breadth; it was probably the monument of an infant. The rest are, in general, fifteen inches broad. All these monuments are placed flat on the ground, in various directions.

Among these sepulchral stones I counted eighteen, scattered here and there, which seemed to be the most ancient, from their workmanship: for they have neither inscription nor date. But they exhibit a peculiar character; being loaded with sculpture in demi-relievo, representing warriors armed with lances, bucklers, poniards, and arrows, and having their heads covered with bonnets in the form of mitres,

On others are seen figures of common horses, among quadrupeds, of an odd and fantastical shape, placed by the side of each other, like the figures on hieroglyphical tables; and in the midst of all these appear combatants. These basso-relievos are generally inclosed with a border, which is itself of a peculiar character. It consists of arabesks, surcharged with knots and ornaments, resembling

resembling flagree work, which cross each other in so many different directions, that it is impossible to form a clear idea of what the sculptors intended to represent.

It is, perhaps, superfluous to observe, that the figures of men and animals are executed without any regard to measure, proportion, ground, or perspective, they are expressed, however, with a kind of neatness. The character, the physiognomy, if I may use the term, of these monuments, have no relation to the Gothic style; and, but for the border which somewhat resembles the Turkish ornaments, there is nothing to which I could so justly compare them as the hieroglyphical figures.

It would be difficult, therefore, to assign the epoch when these monuments were erected; the style of their workmanship being so singular, that a comparison of it with any thing we already know, could be of little advantage to regulate our inquiry.

Some of the natives entertain an opinion, founded on tradition, that they are the sepulchres of the celebrated warriors who lived in the times of the ancient kings of Scotland. But the history of those kings,
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is itself loaded with obscurity and fable. Others suppose that they contain the remains of the heroes of the north, who flourished at the epoch when the Danes made frequent incursions on the coasts of Scotland, of which they gained possession at different times.

But does it not appear very extraordinary that the one or the other should have selected for their place of interment a wild country, encompassed with mountains, scarcely inhabited, at the distance of a days' journey from the sea, and without any road leading to it? What motive could have determined this preference?

Would it not be more plausible to suppose, that this burying-place had been formed in consequence of some great battle near it? But the number of these tomb-stones, and the long and difficult labour requisite to carve them, must necessarily imply a degree of time and leisure, which prove them to be the work of a settled people, to whom the arts, however small their progress among them, must yet have been no strangers.

They are certainly deserving of the attention of the learned society established a few years ago, at Edinburgh, for inquiring into
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the ancient monuments of Scotland, and of another lately formed for the same purpose at Perth. I invite them, by their love of the sciences and their country, to direct their researches to this subject*.

In the mean time, those who are curious to form an opinion of the style of this kind of monuments, may see a representation of one, found in a different part of Scotland, in a work of Mr. Gardiner, minister of the

* If the facts stated by Knox respecting the antiquities of the Isle of *Iona*, or *Icolumkill*, one of the Hebrides, are correct, as there is reason to suppose they are, the ancient monuments abovementioned might indeed have been transported thence. But it is still difficult to believe that they should have been carried so very far inland. "This place [*Icolumkill*]," says Knox, "became also the sepulture of forty-eight kings of Scotland, eight of Norway, four of Ireland, besides the chiefs of the Highland and Hebridian clans, some of whose effigies still remain on the spot, many have been destroyed, and others have been purloined for *other church-yards in the Highlands*."

"I have seen some of these effigies, and also some of the stone crosses, that have been taken from *Icolumkill*. One of the latter stands in the centre of the town of *Campbeltown*; a beautiful pillar, ornamented with foliage. The effigies have been carried mostly to *Argyleshire*, where they are laid over the graves of the principal inhabitants. A number of them may be seen at *Kilmartin*, where the people can give the names of the persons on whose graves they were originally placed."

Knox's Tour, &c.

gospel

gospel at Bamf, entitled, "Antiquities and Views of the North of Scotland; London, 1780," in small 4to. page 64. This book is written in English, and embellished with very fine engravings.

Before I dismiss the tombs of Dalmally, which have, perhaps, detained me too long already, it is with pleasure that I advert to a circumstance that exhibits to those who are attached to the arts, and make them their particular study, a kind of uninterrupted filiation which is very remarkable, though what I am about to mention supposes the art to exist in its infancy only. It will, however, shew how much example naturally inclines men to imitation.

The inhabitants of Dalmally having had these ancient monuments in their view from generation to generation, have not only preserved the same ground as a place of interment for their dead, but have likewise attempted to decorate the stones which cover them with sculpture; not, indeed, in basso-relievo, which might have been too difficult, but in a scooped style.

The mode of ornament presented by the ancient tombs appearing to them too complicated

plicated and unintelligible, they adopted, with a just preference for their own, figures connected with their religion, or emblematical of their professions; and as the lapis ollaris, which they make use of, is not very hard, their labours have never been discouraged by any difficulty of execution.

We, accordingly, saw one of these stones, which had a more modern look than the others, and could not, at farthest, have lain there above five hundred years, with the representation of a crucifix occupying its whole length, but without any ornament or figure of Christ. This crucifix is cut into the stone, and is executed with the greatest precision. There are others gradually less ancient, on which are sculptured hammers, stone chissels, anvils, fishing-boats, nets, and all the various implements connected with the vocation of the persons deceased. The most modern tombs are decorated with hour-glasses, death heads, and armorial bearings.

This successive imitation, supported by religious usage, must necessarily be very limited, and cannot have made great progress in so wild a country. It is singular, however, that men so poor, so destitute of instruction,

and so remote from communication, should have had, during so many ages, and should still continue to have, sculptors of some sort; whilst, in towns of the third rate, it would be difficult to find a man capable of tracing a simple escutcheon, or cypher, on such monuments.

Patrick Frazer came to call me away from my tombs and my reveries, and to announce that we had to visit a very interesting person, who was the possessor of monuments of a different kind.

“ We shall have a quarter of an hour’s
“ walk only to his house,” said Patrick
Frazer. “ The name of this man is Mac-
“ Nab. He has in his possession a precious
“ manuscript, containing several of the
“ poems of Ossian in the Celtic language.
“ You shall have the pleasure,” added he,
“ of hearing him sing them; for the carol-
“ ing of the sublime verses of this ancient
“ poet has always been a sort of amuse-
“ ment, which the inhabitants of the moun-
“ tains and of the Hebrides have preserved
“ and transmitted from generation to gene-
“ ration.”

Mac-Nab’s house is situated on the top of
the same hill on which the inn stands. We
proceeded

proceeded to the place. " I should inform
" you beforehand," said Patrick Frazer,
" that the kind of bard whom we are going
" to see, is at once a lock-smith, black-
" smith, armourer, and ironmonger, which
" renders him very useful, and very much
" esteemed. He is, besides, endowed with
" sound sense, and a striking native wit,
" which will afford you much pleasure."

His house stands in the midst of a group
of habitations, which form a small hamlet.
We entered his workshop, which is neither
large nor magnificent. His brother did us
the honours of the place, and received us
with the most agreeable demonstrations of
politeness and friendship. He told us, that
his eldest brother had gone from home two
days before, and that he would be very sorry
for having lost the opportunity of receiving
strangers who had come so far to pay him a visit.
" I cannot," said he, " do myself the plea-
" sure of shewing you the treasure, of which
" our family has been in possession for more
" than four hundred years, because my brother
" keeps it under lock and key. But if you
" could remain here during the rest of the
" week only, he would be at your command,

“ having designed to be home in three days
“ hence. He will recite the verses of
“ Ossian, and tell you some very curious
“ things respecting that great poet. As to
“ myself, I can have the pleasure only of
“ shewing you the buckler of my great
“ great grandfather.”

He accordingly brought us, a moment after, a large buckler, of a round form, made of wood, overlaid with copper, and decorated in the centre with the representation of a rose, likewise of copper. This buckler, known in the language of the country by the name of *target*, was of a solid and neat construction, but somewhat decayed with age. This good man, whose expressions were literally interpreted to us by Patrick Frazer, then brought us, with the most obliging readiness, several pieces of iron armour, which had been found a few years before in the ruins of an old castle in the neighbourhood. They were nowise different from the armour of the fourteenth century.

On casting my eyes round Mac-Nab's workshop, where his brother received us, my attention was attracted by a poniard, of
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an elegant form. Its handle was made of wood only, but of a very hard kind. It was sculptured in a style of the most exquisite taste, and of the most perfect and finished workmanship. The sculpture consisted of vermiculated knots, formed in clusters, and passing and repassing each other in the most graceful manner, and without the smallest confusion.

It is not improbable that the first model of this poniard, and also of the dress of the Highlanders and Hebridians, was taken from the Romans, with whom they were long at war. For the *plaid*, the short jacket, the durk, the *target*—that is, the mantle, coat of armour, and buckler—were part of the accoutrement of a Roman foldier. I must repeat, that some very powerful motives must have attached them for ages to that mode of dress, which is incontestibly the worst adapted to a climate so wet, and where the winter is so long.

I asked Mac-Nab's brother whether he would sell me the poniard, for which I said I would give him a handsome gratuity. "It is not ours," replied he; "it belongs to one of our friends in the mountains, who

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" has

“ has received it from his ancestors, and
 “ who would not part with it for any price.
 “ He has left it for repair with my brother,
 “ who is able to make you one in every re-
 “ spect similar, if you wish it.” Upon that,
 he pulled out a drawer, in which there lay
 several in an unfinished state. “ We never
 “ deviate,” said he, “ from this form,
 “ which is a very good one, being agreeable
 “ to the eye, and affording, at the same time,
 “ a solid hold to the hand which uses it.
 “ All the weapons of this kind which are
 “ made here, or in the neighbouring moun-
 “ tains, are of the same form with these,
 “ and that from time immemorial*.”

* M. F. Hill, who travelled in the mountains of Scot-
 land with the intention of seeing the country, and at
 the same time of making critical researches respecting
 M'Pherson's translation of Ossian, published a pamphlet, of
 which he kindly gave me a copy, when on his travels in
 France. This publication, which contains only thirty-six
 pages of printing, is entitled, *Ancient Erse Poems, collected
 by M. Hill, among the Scottish Highlands, in order to il-
 lustrate the Ossian of M'Pherson.* This traveller, in going
 past Dalmally, did not omit calling upon Mac-Nab, who
 boasted to him that all his ancestors, for four hundred years
 back, had been blacksmiths. Mr. Hill says that he was
 far from wanting sense and information; and that he is
 placed, by Mr. Smith, among the authorities for his collec-
 tion of Erse poems.

Mac-

Mac-Nab, after receiving us so politely in his brother's house, requested, with great importunity, that we would accompany him to his own, where we were expected; assuring us, at the same time, that such a favour would do him a great deal of honour among the inhabitants of the place. We yielded, with pleasure, to his invitation.

The cottage, or rather hut, which he inhabited, was buried several feet in the earth, as a security against the most intense cold; but being placed on an elevated situation, it was, notwithstanding, entirely safe from humidity.

It was supplied with every thing requisite to form a comfortable dwelling in such a place. It was divided into two apartments, besides a closet on the ground-floor; for the inhabitants of this region never think of building their houses with stories; with them rural architecture is still in its primitive state.

The apartment to the right of the entrance contained some sacks of barley, and a quantity of oatmeal. These are the only kinds of grain which arrive at maturity in this country; and though they are seldom

reaped till about the middle of October, it is further necessary to dry them on kilns. We saw there, also, some bottles of whiskey, a kind of aqua vitæ, distilled from barley. It is of a bad quality, and an empyreumatic taste; but it constitutes their best liquor, and is their favourite luxury. We were also showed a very neat press, in which there was some linen, and several elegant *Roman* dresses, appropriated for their holidays. The same room, though it was not very large, and also the closet, contained some simple and plain dairy utensils, and a quantity of peats, very artfully built up against one of the walls. The smallest corners of this little place were applied to use, and every thing was in its proper position. We soon saw that the brother of Mac-Nab was a lover of order.

The second apartment seemed to be used as the chamber of presence. Here his relations were assembled, and waited to receive us with due ceremony.

A peat fire, which was kindled on a large round stone, raised ten inches above the floor, and placed in the middle of it, served to warm the room. The smoke passed vertically

tically through an aperture in the top of the roof. A rustic wainscoting, constructed in the form of an inverted mill-hopper, begins at this aperture, and gradually enlarging itself, descends to within four feet of the ground, at the distance of three feet from the walls. It is, therefore, necessary to stoop on entering this room, or rather chimney; for it may be truly said, that the place where the family received us, was in the chimney itself. This construction is well adapted to preserve them both from smoke and cold; and one feels very warm in that kind of wooden box, which retains the heat well. Two small openings had been made in the chimney to admit the light. Wooden benches were ranged all round the interior part, that is, the chimney. Mac-Nab's relations, who were gravely seated on these benches, rose up as we entered, bowed towards us, and made signs for us to be seated also; they appeared nowise embarrassed. Patrick Frazer acted as our interpreter, and presented our compliments.

We were no sooner seated, than a young man shut the window; and a second lighted a lamp, of a peculiar form, which yielded
a great

a great flame, accompanied with a resinous smoke. This household lamp consisted in a kind of iron shovel, bent towards the bottom, and suspended by a long handle in a corner of the chimney, within reach of the spectators. On this were lighted pieces of resinous wood, chiefly cut from the *pinus tæda*, and well dried, which gave a very bright flame, intermixed, however, with a great deal of smoke. The person appointed to supply the lamp, has beside him a stock of this wood cut into small bits, with which he constantly replaces what is consumed*.

It was by the light of this extraordinary luminary, that Mac-Nab, taking by the hand a young, agreeable and modest girl, whom I presumed to be his daughter, ushered her into our presence. She brought in a very neat and clean wooden bowl, filled with milk, which she offered to one of us, courtesying at the same time with a little timidity and embarrassment. But, on being encouraged by her father, she drank first

* Though this wood is now so extremely scarce in the country, that there can hardly be seen a tree of the kind, a number of old stumps of it are still found at the depth of several feet in the peat mosses.

herself,

herself, and passed it to the person to whom she had before presented it. It then passed from hand to hand, or rather from mouth to mouth, until every one had tasted it, when it returned to Mac-Nab, who closed the ceremony with much solemnity. It should be observed, that we were all standing at this moment. There is a sort of religious solemnity in this hospitable usage, arising from the desire of giving a kind reception to strangers: it is regarded among them as a sacred duty.

We were then presented with butter, cakes made of oatmeal, and a glass of whiskey. We returned our best thanks to this good family, who positively insisted on accompanying us back to the inn*. Patrick Frazer

* The celebrated Johnson visited, in Invernessshire, a less commodious habitation. His account of it deserves to be copied here,

“ Near the way, by the waterside, we espied a cottage,
“ This was the first Highland hut that I had seen; and as
“ our business was with life and manners, we were willing
“ to visit it. To enter a habitation without leave, seems
“ not to be considered here as rudeness or intrusion. The
“ old laws of hospitality still give this licence to a stranger.
“ When we entered, we found an old woman boiling
“ goat’s-flesh in a kettle. She spoke little English, but we
“ had interpreters at hand; and she was willing enough to dis-
“ play

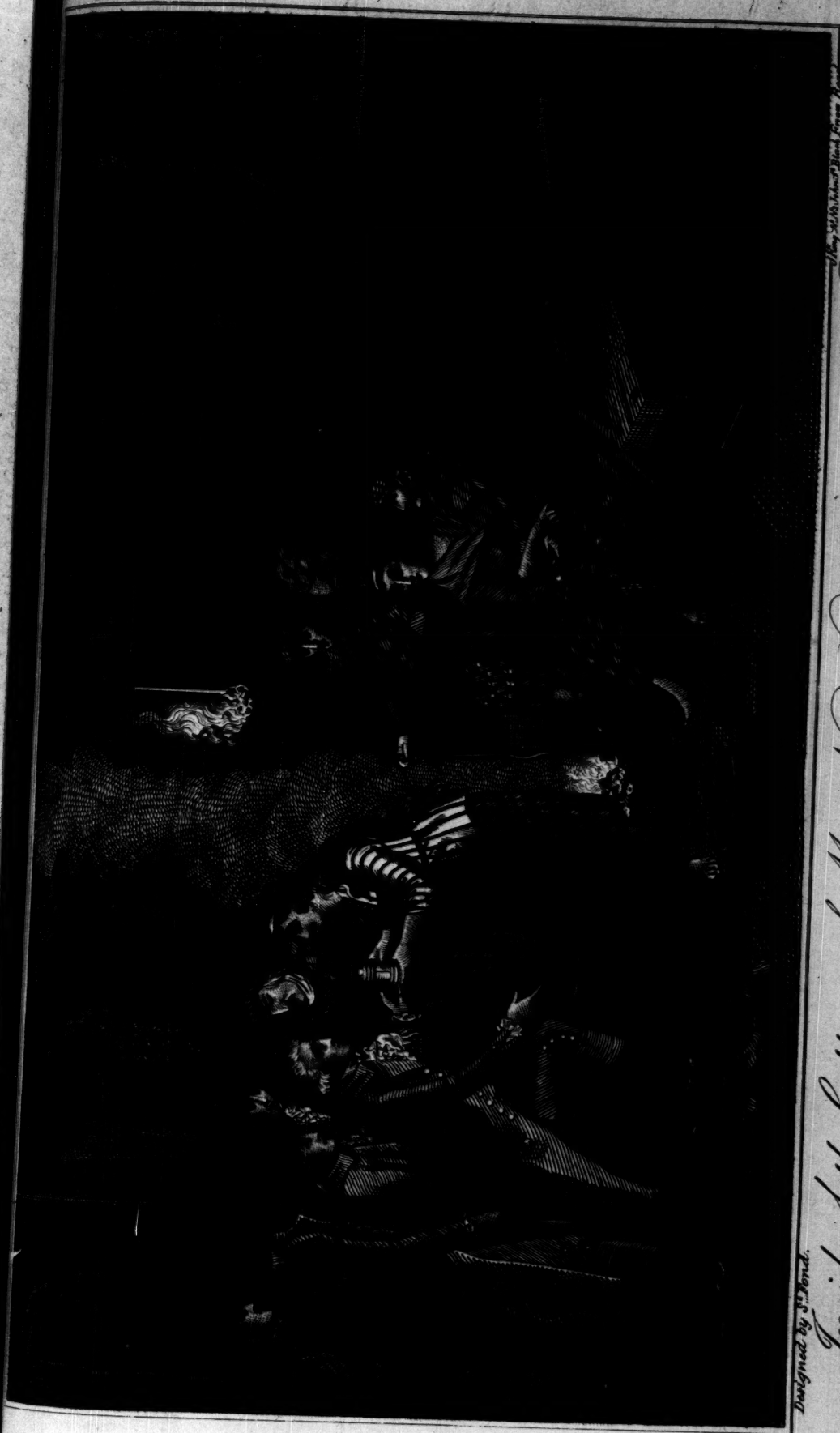
Frazer assured us that it would be considered as an insult by these obliging people to offer them the most trifling gratuity. This scene appeared to me so interesting, that I made our draughtsman take a sketch of it while we were in the house.

On leaving his house, Mac-Nab shewed us, on a small hill, at a little distance from it, a simple, but ancient, monument, for which the people of the country entertain a sort of veneration; being informed, by tradition, that this kind of monuments, which bear in their language the name of *cairn*, signifying a druidical circle, were in former times consecrated to the religious ceremonies of the Druids. This one consisted of a small circular inclosure, formed by large rough blocks of granite.

“ play her whole system of economy. She has five children,
“ of which none are yet gone from her. The eldest, a boy
“ of thirteen, and her husband, who is eighty years old,
“ were at work in the wood. Her two next sons were
“ gone to Inverness to buy *meal*, by which oatmeal is
“ always meant. Meal she considered as expensive food,
“ and told us, that in spring, when the goats gave milk, the
“ children could live without it.

“ With the true pastoral hospitality, she asked us to sit
“ down and drink whiskey. She is religious, and though
“ the kirk is four miles off, probably eight English miles,
“ she goes thither every Sunday.”

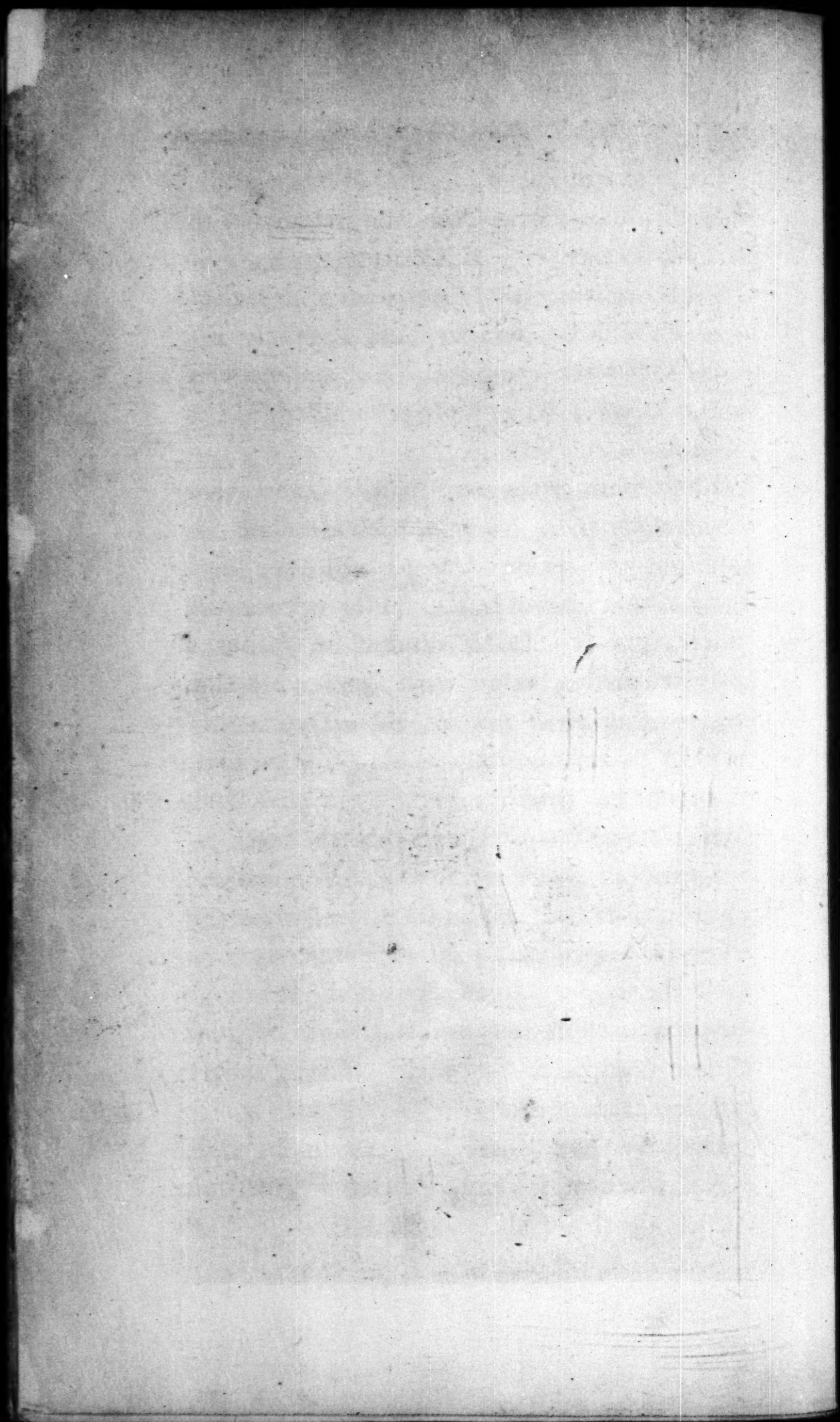
After



Designed by S. D. Bond.

Inside of the Cottage of Mac-Nab: a Blacksmith at Dalnally
who preserves some fragments of the Poetry of Glean.

W. H. & Co. Edinburgh, Glasgow, & London.



After examining this kind of rude altar, we prevailed on Mac-Nab and his family to proceed no farther. But during this contest of politeness, another Highlander approached us in an affable manner, and urgently requested that we should also pay a short visit to his family, who were assembled to receive us.

This man, who was richer and more ostentatious than Mac-Nab, had made his wife put on her best finery, while we were in the house of the latter. Her decoration, which appeared to be finished in rather a hasty manner, though with some pretension to elegance, gave her an air of embarrassment by no means disagreeable. She came up to inform us, that the fire was lighted, that the table was covered, and that the most excellent whiskey waited for us. We excused ourselves, as well as possible, from want of time, shewing her at a distance our carriages with the horses already put to. We then thanked herself, her husband, and the rest of her company, for their obliging offers, and departed.

But we had scarcely gone a hundred paces, when our friend, Patrick Frazer, said
to

to me :—" You have painfully wounded the
" feelings of that family, who are in easy
" circumstances, and much respected in the
" country, by refusing to enter their habita-
" tion, while you visited that of Mac-Nab.
" That sort of exclusive preference is re-
" garded as very humiliating among the
" Highlanders." This observation made us
trace back our steps to repair the involuntary
injury. But the mistress of the house, on
seeing us return, shut the door with an
appearance of resentment, which prevented
us from going any farther. We were ex-
tremely sorry to find that we had given pain
to persons of so much goodness and hos-
pitality.

CHAPTER XII.

Departure from Dalinally.—Loch-Awe.—Rocks of micaceous Schistus.—Porphyry.—Bun-Awe.—A Cairn, or druidical Monument.—An ancient Christian Cross in Stone.—Benighted on the Road.—A violent Storm.—Lose our Way at Midnight.—One of our Chaises overturned in a small River.—Pleasant Adventure with an Old Miller.—Arrival at Oban.

THE distance from Dalmally to Oban is about twenty-four miles; and the road is so bad, that it is scarcely passable in carriages. It was ten o'clock before we set out, but the day being fine, we thought we might reach Oban by night.

We travelled close by the side of Loch-Awe throughout the whole of its length. It is of an oblong form, and more than ten miles long. A road was begun to be opened, at a very great expence, about halfway up the chain of hills which border this lake.

The

The traveller is here threatened with two great dangers, that of being precipitated from a height of more than four hundred feet into the lake, if a carriage should have the misfortune to overturn in this narrow passage, or that of being crushed by the enormous pieces of rock which overhang the road, and which frequently fall from the craggy summits, to which they are but slightly attached. In this situation it is prudent to travel on foot in the most dangerous places of the road: we, therefore, came out of our carriages; but were repaid for our trouble by a number of delightful prospects, which were best enjoyed in walking. This beautiful lake is full of little woody islands. One of these is rendered remarkable by the vast Gothic ruins of the castle of Kilchurn, another by a fortress, partly destroyed, and a third by an ancient chapel, in a very picturesque style. High mountains circumscribe this landscape, and give it a solemn, solitary aspect, which is softened by the fine waters of the lake, by the woods which cover its banks, and by the remains of buildings, which fill the mind with recollections of ancient times.

In

In some places, the road resembles that which leads from Monaco to Genoa, and which is called *The Cornice*. The path is cut through the rock in the same manner. The first range of mountains, which are the most craggy, are composed of a grey *lapis ollaris*, divided into very thick banks. These magnesian stones vary in the fineness of their grain, in their colour, and in their texture. Some of them are in grain and colour similar to those which are in Italy made into culinary utensils. Others, which are softer to the touch, and of a blackish colour, are susceptible of a fine unctuous polish. Another kind is of a fibrous contexture. These beds are crossed at different distances by veins of white quartz.

We proceeded thus for the space of twelve miles in this difficult road, often cut through rocks, or constructed among rubbish, without meeting with a single cottage; we only saw upon a declivity, somewhat woody, a few cabins, which, we were told, were inhabited by colliers.

The nature of the stones changes on approaching the thirteenth mile; their colour is a violet-red. Here the moun-

tains recede a little; but their elevation becomes more considerable. These mountains are composed of porphyry, and the road, which there widens, is formed of the detritus of that stone.

On a small arm of Loch-Awe, by which it discharges the excess of its waters into Loch-Etive, there is a bridge at a place called *Bun-Awe*. The natural canal over which this bridge is built, is called *Pool-Awe*. Loch-Etive, into which it runs, which communicates with the sea, and stretches up this far among the mountains, is navigable for large vessels.

The porphyric rocks, which form the neighbouring mountains, have experienced so much waste, either in consequence of being detached and falling down by their own weight, the operation of frost, or other destructive causes, that the base of the hills is covered with heaps of porphyry, broken into small pieces. These fragments have accumulated to such a degree, that they form little hills at the bottom of the elevated chain from which they have fallen. This porphyry, which has a basis of trapp, and is of the colour of the lees of wine, has a great tendency

tendency to separate into angular pieces of various forms.

The crystals of felt-spar, which enter into its composition, are almost all of an irregular form: but the most remarkable circumstance, and that which particularly deserves the attention of the naturalist, is that in the soil formed of this detritus, there appear fissures, where, in consequence of daily infiltrations, the particles of felt-spar have separated from the substance which contained them, in order to concrete into solid bodies, which have a tendency to crystallization. These have some resemblance to the felt-spar of Baveno, but have not the same regularity as this kind of secondary regeneration of felt-spar is here performed in a very rapid manner.

These crystallizations may be seen in some of the chinks of this moveable soil, at a short distance from Bun-Awe, upon the right bank of the stream that serves as an outlet to the loch.

Somewhat higher, and without the bed of the river, there are heaps of broken porphyries, which are harder, and have no tendency to decomposition. The crystals of

felt-spar, which are found here, are of the figure of parallelopipeds, pretty regular, and white, while the basis of the porphyry is a greyish red. Some pieces are found in which the basis is yellow.

Engaged in our observations, and employed in collecting specimens of the different stones we met with, we did not calculate the time we spent at this spot. There still remained twelve miles of our journey, and we were assured that the road was no better than that we had already passed.

We crossed the bridge of Bun-Awe, beyond which we saw two solitary habitations, the residence of shepherds; and about a mile farther on, a small inn, on the wayside, surrounded with a few houses. We found it necessary to stop here for half an hour to refresh our horses. Meanwhile I visited a small church, situated upon a neighbouring eminence, in the burying-ground of which I observed two sepulchral stones, of the same kind as those I had seen at Dalmally, and the sculpture of which was equally ancient. They appeared, however, to have suffered more from the operation of time.

We should, perhaps, have acted more prudently,

prudently, had we stopped all night at this little inn, bad as its accommodation was ; for there was no other house between it and Oban : but Patrick Frazer assured us that we might proceed, for he had formerly gone the same journey ; that we had still five hours and a half of daylight ; and that the moon, which would soon rise, would light us for the remainder of the road. We followed his advice and departed.

In a few minutes after we had set out, we observed on the side of a hillock, fronting the road, a cross, formed of black stone, of the nature of slate, upon which a figure of Christ was carved in demi-relievo. The style of the figure was indifferent, but the execution was fine. The figure, and the cross were of the same piece, and the stone was about five feet high.

We were astonished to see a religious monument of this kind so well preserved in a protestant country. An old shepherd, who came up while we were looking at it, told us that he had been informed by his parents, that this cross had stood in that place for more than four hundred years ; and that although there were no Roman

Catholics in the parish, and though all their images had been destroyed at the reformation; yet this cross had been allowed to remain. He could assign no reason for this singular circumstance, except that the people of the country having been accustomed to see it from father to son, had preserved a kind of respect for it, though they did not pay to it any devotion.

A large column of rough stone was at the same time pointed out to us at the distance of five hundred toises from this cross. We were told that the *Romans had sacrificed upon it to their false gods*. Such were the words of an inhabitant of the country, who appeared to be a school-master, and who spoke a little English. We could not resist our desire of examining this ancient monument more closely, especially as we could do so without going far out of our way. It is a granite, of a yellowish grey colour. Its shape is triangular, but it is as nature formed it; for it is impossible to discover upon it the smallest trace of art. It is erected on a marshy soil, in a kind of peat-moss. I measured it, and found that its height above the ground was ten feet, and

and that there were four below, which make its length fourteen feet, French measure. Its mean breadth I found to be about two feet, and its thickness two and a quarter.

At a short distance from this pillar there is a circular space, about twenty-four feet in circumference, formed by large blocks of rude granite. It is one of those very ancient monuments, called *a cairn*, that is a Druidical circle *.

We

* Let us listen for a moment to Pennant, on the subject of these ancient monuments:

“ Take a ride into the country:” (the isle of Arran)
 “ descend into the valley at the head of the bay; fertile
 “ in barley, oats, and peas. See two great stones in
 “ form of columns, set erect, but quite rude; these are
 “ common to many nations; are frequent in North
 “ Wales, where they are called *main-birion*, i. e. tall
 “ stones, *meini-givir*, or men pillars, *lleche*; are frequent
 “ in Cornwall, and are also found in other parts of our
 “ island: their use is of great antiquity; are mentioned
 “ in the *Mosaic* writings as memorials of the dead, as
 “ monuments of friendship, as marks to distinguish places
 “ of worship, or of solemn assemblies (1). The northern
 “ nations erected them to perpetuate the memory of great
 “ actions, such as remarkable duels; of which there are
 “ proofs, both in Denmark and Scotland; and the num-

(1) Joshua xxiv. 26.

We employed an hour and a half in examining this cairn: our curiosity made us forget that we had still a great way to go, and that the sun was declining fast. Heavy clouds began to darken the horizon, and as the day had been very hot, we feared that the night would be attended with storm. We, therefore, desired the post-boys to drive smartly, which they were very willing to do, as they observed that some drops of rain already fell by intervals.

Notwithstanding the badness of the road, we got forward at a good pace for nearly an hour; but night came on, and the clouds seemed to dash against each other. We heard the tempest growl at a distance. The moon was not yet visible, but had she been risen she would have been covered with dark clouds. The thunder roared, and vivid flashes of lightning succeeded each other. We proceeded, however, in some

“ber of stones was proportionable to the number of great
“men who fell in the fight (1): But they were, be-
“sides, erected merely as sepulchral, for persons of
“rank (2), who had deserved well of their country.”
Pennant's Tour, 1772, part ii. page 203.

(1) Wormii. Monum. Dan. 62. 63. Boëthius, Scot. Prisc. et
recentes mores, 10. (2) Hist. Scot. 20.

degree of security during half an hour, when with a tremendous clap of thunder, all the force of the storm burst above us. A deluge of rain poured down. The darkness increased, and in a few minutes it was not possible to see the road.

Patrick Frazer got out of the chaise, went before the horses, and groped with his hands for the track of the road: the horses, terrified by the noise of the torrents, by the lightning and the thunder, moved slowly along, and halted at every step. At last our conductors advised us to come out of our carriages, notwithstanding the dreadful rain; for they found that we had lost our way, and were afraid that we might be overturned, and fall down some precipice.

We did as we were directed, and it was full time to adopt this course; for we were upon the edge of very steep rocks, some supported the chaises, some held back the wheels, and others endeavoured to find some traces of the road. In this manner we proceeded slowly onwards, with much trouble and great fear, not knowing where we were, nor where we were going.

At ten o'clock Patrick Frazer, hearing the
noise

noise of the sea, said, " We are completely
" out of our way, there is no doubt of it.
" I cannot tell where we are. Oban, how-
" ever, cannot be far off; for we have
" travelled a long time, and we now hear
" the sea; it appears that we have got
" upon some elevated place, and we must
" use all our prudence to rectify this wrong
" step."

At midnight our danger and difficulties increased; we heard the waves of the sea dashing frightfully against the foot of the mountain on which we were. This increased our fears, and we stopped every moment to consult upon which way we might turn with safety.—Such was our situation in this wild region: embarrassed by our horses and carriages; creeping along steep and slippery declivities, where it was scarcely possible to keep our footing, and the rain continuing with increased force.

The activity of Patrick Frazer was great, and he was always the foremost upon the look-out. He came back to inform us that it was necessary to turn to the left, to avoid falling into the sea; that he believed he heard a stream about two hundred toises distant,

distant, and that by gaining its bed we might find some outlet from the rugged track in which we were involved.

We turned and arrived with great difficulty, at the brink of a small torrent ; but the declivity of the bank was rapid, and the noise of the water announced a deep hollow. It was, however, necessary to attempt this difficult passage through briars and stones. The first carriage and chaise got down without any accident. The second overturned, but was got up before the horses were hurt, and there was nothing damaged but some of our baggage. The third succeeded better.

Having entered the bed of the rivulet we coasted along its banks, walking up to the knees in water. In about a quarter of an hour the noise of a cascade, not far from us, suddenly stopped our progress. A ray of the moon penetrated through the dark clouds, and by its light we observed a few tufted trees, a small meadow, and some cultivated fields. " We are not far from a house," exclaimed Patrick Frazer, " we must call for help to enable us to get out of this abyss."

Wet

Wet from head to foot, trembling with cold, and worn out with fatigue, we assembled round our carriages below some firs, hollowing as loud as we could, to induce any persons who might be within hearing to come to our assistance. This scene appeared to me so ridiculous, that I could not avoid bursting into laughter; indeed nobody was hurt, and none of us were inclined to be dejected by the accidents that had happened; on the contrary, we rather chose to enliven the conversation with some pleasantries.

William Thornton, who possessed a lively imagination, and was passionately fond of the ancient poetry of this country, observed that the place where we were, was not without charms; that it was calculated to inspire grand and romantic ideas; and if he had a glass of rum to drive away the cold, he should be able to write an ode immediately.—“We are,” said he, “among those mountains which the exploits of Fingal have for ever signalized. The immortal Ossian has trod upon this ground.—His name is dear to the Muses, —My imagination warms!”

He

He had scarcely repeated these words, which he pronounced with a tone of enthusiasm, when an old man, with his head uncovered, his hair white, and dressed in a floating drapery of the same colour, started up before us. "It is Ossian!" cried Thornton, "it is the divine poet himself! Let us prostrate ourselves before him." The figure, however, which said not a word in reply to this address, and even did not deign to cast a look towards us, stalked gravely across the stream, and suddenly disappeared.

Is it an illusion? Is it a dream? We all exclaimed; for we had all seen the same object, seen it distinctly by the light of the moon. We were astonished, and remained for some time in a state of uneasy expectation; at last we heard the voices of men coming to our assistance. From them we learned that the water-fall was only the sluice of two mills, which had been opened, and the white phantom an old miller, who, awakened by our cries, ran in his shirt bareheaded to our assistance; but who, seeing horses and carriages, and hearing a language

language which he did not understand, went off, without saying a word, to call his neighbours. These obliging highlanders came eagerly to help us out of our difficulties. They could not conceive how our carriages had descended the steep bank of the stream without being dashed to pieces. It required all the address and strength of these athletic men to draw the chaises out of this abyss. They formed a kind of road with pick-axes, and carried the chaises, as it were, on their shoulders.

They accompanied us to the village of Oban, which was only about five hundred toises distant, and conducted us to the only inn in the place. They made the landlord rise, who was not a little surprised to see three carriages, with ten persons, at his door, at half past one in the morning, in such a pitiable condition. We testified our gratitude to the good highlanders who had assisted us in so frank and hospitable a manner. A large fire was lighted to dry us, and after drinking a good deal of tea and some rum, we went to bed at four in the morning, and slept till ten : the sleep refreshed us, and

and except some slight contusions, and some remaining fatigue, all our troubles were forgot when we rose.

This adventure may appear somewhat romantic; it was notwithstanding in all its circumstances as I have related it. Two motives have induced me to mention it. The first:—to pay a just homage to the fortitude of my dear fellow travellers, who bore the fatigues and the dangers of the night like worthy naturalists, and often laughed at this event, which happily had no disagreeable consequences. The second:—to be useful to those whose taste for natural history may urge them to visit this little frequented country, by informing them that it is absolutely necessary to set out early from Dalnally to go to Oban; and that if the weather be bad, or any accident delay their progress, it would be prudent to stop at halfway, and sleep at the little inn above the bridge of Bun-Awe, however bad the accommodation may be; for, from that to Oban there is no habitation.

The port of Oban is large and safe, and were it not obstructed by some small rocks, which might be easily removed, it would be capable of

of receiving a large squadron *. Notwithstanding this advantage, all the shipping of this

* Speaking of this port, Knox says, " Oban lies in that part of Argyleshire, called Mid-Lorn. It has a good highland country behind, with a freestone quarry, Mull and other islands in front, and is of itself capacious, and sufficiently deep for the largest ships. Without, is the island of Kerera, three miles in length; between which, and the main land, is the sound of Kerera, a good road, through which coasters and fishing vessels generally pass, between the Clyde and the fishing grounds in the north highlands. This coast, and the island of Kerera, have also a free navigation to the white fisheries of Bara, and the herring fisheries on the northwest coast of Ireland.

" A custom-house is already erected, something is done in ship-building, and above twenty families have been collected together, with a view to the fisheries.

" But these are inferior considerations to the natural advantages which may be derived from this much-frequented harbour and road.

" Oban is formed by nature, and by a combination of favourable circumstances, for being a principal harbour, a place of trade, a central mart for the South highlands, and the numerous islands that lie in its vicinity."

This author adds the following words in a note. " Mr. Murdoch Mackenzie was employed by government to survey the west coast of Great Britain, from Cape Wrath to the Bristol Channel; also the coast of Ireland; which he executed with great attention, and much to the satisfaction of the seafaring people of the three kingdoms. I propose, therefore, to corroborate my own remarks, by extracts from what he calls

" *Nautical*

this place, at the time we arrived, consisted of four small vessels, which had failed on the herring-fishery, and two wretched boats, which belonged to the brothers Stevenson.

The voyage we had to make from Oban to the Bay of Arros was at least thirty-three miles, in the rapid currents of the strait which separates the Isle of Mull from the rugged coast of Morven. I did not think it very prudent to attempt this passage in a small boat with herring-fishers, who did not understand a word of English; upon a sea, too, which is full of dangers, continually subject to tempests, and of which both Pen-nant and Johnson have given so discouraging a description.

I had read in the work of the latter the

“ Nautical Descriptions of the West Coast and Western Islands of Scotland, from Cantire to Cape Wrath, and the Butt of the Lewis.”

Speaking of Oban, he says, “ In the sound of Kereray there is very good anchorage for ships and vessels of any size, and it is a convenient place for vessels that are bound either northward or southward. The best parts to ride in, are in the bay of Oban, and opposite to Oban, near Keraray, and between the Ferry-house of Keraray and Ardnachroik, nearest the latter, on eight or ten fathoms, without going within the bay; for it shallows fast near the shore.”

affecting episode of the death of that brave and promising youth, Donald Maclean, of Col, who perished in the short passage from the isle of Ulva to Inch-Kennet. The impression made upon me by this melancholy narrative was so great, that although the sea was pretty calm, I felt the greatest repugnance to embark in the small and ill-built boats to be found here, and which could only carry four passengers and two rowers*.

I should, however, have overcome this kind of aversion to the voyage, which proceeded less from real danger, than the recollection of the indisposition which I always experience at sea, if our hosts had not informed me that they expected a stout fishing smack to arrive in two days at farthest: this vessel was to take on board some provisions at Oban, and then to proceed to the Isle of Sky; and I was assured that I might agree with the captain to land me in Mull.

I therefore allowed my companions, who were afraid that bad weather would set in, to depart on board of the two little boats

* "To go up the Sound of Mull," says Knox, "even in the most favourable season, was a dangerous experiment for a small open boat, such as Oban afforded."

which

which the brothers Stevenson provided, assuring them that I should sail with the fishing smack, which was so soon expected, and thus would not be long in rejoining them. Meanwhile, I told them, I should employ myself in examining the mountains in the neighbourhood of Oban, which appeared to be very interesting.

It will be seen in the sequel how this kind of foreboding, which proceeded merely from the caprice of imagination, turned to my advantage. My friends sailed in the two little boats; and it was agreed that they should wait for me at Mr. Maclean's, in the Isle of Mull.

I remained, then, alone with a servant in this desert place, at the extremity of Scotland, among men who spoke a particular language, perfectly distinct from the English. I could only make myself understood by signs; but necessity gives birth to industry in every situation; and, besides, I knew that I should remain very little in the house. The mountains, which surrounded me, were so varied, and so remarkable, and presented so rich a field of observation, that I proposed to myself to examine them with the greatest

Y 2 attention.

attention. The pleasures of novelty and instruction have a powerful charm, which I sufficiently felt to indemnify me for some temporary privations, and I was convinced that a few days would rapidly pass away when employed in researches of this agreeable kind.

Furnished with pen, ink, and paper, to enable me to make such memorandums as I should think necessary on the place of observation, and taking with me some physical and mineralogical instruments, I set out at daybreak, with a knapsack on my back : a domestic, my faithful companion, accompanied me, who carried on his part a bottle of wine, and some cold meat ; which, however, we did not taste until after several hours of labour.

We then took our frugal, but excellent, repast. Sometimes seated on the summit of a steep rock, sometimes in a sequestered cavern on the rocky shore, where the waves, breaking at our feet, exhibited the spectacle of a raging sea, upon which we rejoiced that we were not embarked.

In the evening I returned to my peaceful habitation, loaded with stones and instructive
notes.

notes. I spread all my riches upon a table ; I put them in order, and admired them, but I did not contemplate them with the feelings of a miser ; for I amused myself in planning the distribution of what I had collected, among my correspondents and friends—and I was happy.

The labour of the day made me enjoy my supper with particular pleasure ; and sleep soon weighing down my eyelids, I hastened to bed : it was hard, but, in other respects, good, and fatigue converted it into down.

But there is no perfect happiness in this world. Will it be believed that a music of a kind new to me, but shocking to my ear, deprived me of the repose I so much wanted ? I had scarcely time to lie down in bed when an unlucky piper used to come and place himself under my window. At first he waited upon me every evening in the passage of the inn, to regale me with an air ; he afterwards took his station in the front of the house, where he made his noisy instrument resound until eleven o'clock, and I could fall upon no means to prevail upon him to be silent. He thought his music was agreeable to me, and it was his wish to do

me a kind of honour, of which I in vain endeavoured to convince him I was unworthy.

On the day of our arrival, this man came under the windows of the room into which we were shewn : with a bold countenance, and a martial air, he walked backward and forward, stunning us with sounds of the most unharmonious kind. At first we imagined that he was a kind of madman, who earned a livelihood by this strange exhibition ; but Patrick Frazer assured us, not only that this honest man was in his senses, but that he had the reputation of being an excellent musician of the highland school ; that his principal intention in playing on his instrument before us was to exhibit his joy at our arrival in a country so seldom visited by foreigners. Affected by this hospitable motive, I was prodigal in my applauses on his art, and begged of him to accept some shillings, which he at first refused, and seemed only to receive that he might not displease me. He played always the same air, if I may give that name to a kind of composition unintelligible to foreigners, but which brings to the recollection of the highlanders events which have the greatest interest with them. The
piper

piper had observed that my companions were gone, and he persuaded himself that I remained behind to hear his music: imagining, therefore, that his concerts would be most agreeable to me in the silence of the night, he continued his serenade under my window to eleven or twelve o'clock. Nothing could induce him to desist. I rose one evening with great impatience; but not being able to make myself understood by speech, I took him by the hand to lead him to a distance. He returned, however, eagerly to his old place, as one who was determined to dispute a point of politeness, expressing, by his gestures, that he was not at all fatigued, and that he would play all night to please me; and he kept his word. Next day I forced him to accept a small present, and made signs to him that I did not wish to hear him any more; but he was not to be outdone in civility; and that very evening he returned, and made his pipe resound until midnight, playing constantly the same air*.

There

* "The solace," says Johnson, "which the bagpipe can give, they have long enjoyed; but, among other changes, which the last revolution introduced, the use of the bagpipe begins to be forgotten. Some of the

There are at Oban several species and varieties of very curious rocks, which occupy a space of about eight hundred toises along the shore, and one thousand or eleven hundred broad: this vast collection of different stones, deposited here by nature, in consequence of some great revolution of nature, deserves the attention of those who love studies connected with the theory of the earth.

A boisterous sea, which beats furiously against the steep rocks, that serve it for a barrier, has disclosed the structure of these hills, which appear to have been heaped one above another by terrible convulsions, and by the action of the two elements of fire and water, in constant opposition to each other.

The bases of these mountains are so worn away, that their flanks are, in a manner,

“ chief families still entertain a piper, whose office was
“ anciently hereditary. Macrimmon was piper to Mac-
“ leod, and Rankin to Maclean of Col.

“ The tunes of the bagpipe are traditional. There has
“ been in Sky beyond all time of memory a college of
“ pipers, under the direction of Macrimmon, which is
“ not quite extinct. There was another at Mull, super-
“ intended by Rankin, which expired about sixteen years
“ ago. To these colleges, while the pipe retained its ho-
“ nour, the students of music repaired for education. I
“ have had my dinner exhilarated by the bagpipe at *Armi-*
“ *dale*, at *Dunurveg*, and in *Col.*”

laid

laid open, which gives the observer an opportunity of studying the materials which compose them. He is at first astonished to find so much variety and so much confusion. However great his knowledge, he would soon find himself puzzled, if the vestiges of subterraneous fires, which are easily recognized, did not enable him to explain this discordant collection, so contrary to the usual course of nature.

I examined and re-examined these different materials, with great perseverance; and, far from being discouraged by this chaos, I felt an increasing interest in exploring it. I was animated also by the desire of being useful to those who should visit the same place after me, by fixing their attention on the most remarkable objects, and presenting them with the sketch of a labour which may put it in their power to make more discoveries than I have done, without having the same difficulties to encounter.

CHAPTER XIII.

Natural History of the Environs of Oban.

I HAVE thought it convenient to adopt the following division for the more orderly arrangement of my observations.

CALCAREOUS MATTERS.

Though the mountains of Oban are, in general, composed of argillaceous schistus, lapis ollaris and steatites, or of trapps, porphyries, and compact or porous lavas, and sometimes of a mixture of all these substances united and agglutinated together, yet there are also found in them calcareous stones.

This stone, which is here of a black colour, may be seen on the beach, at a little distance from the inn to the right. It is disposed in fissile strata like slate, but is, at the same time, hard, sonorous, and nowise transparent in its fracture. It has a fine grain, and splits into plates from an inch to an inch and a half thick. The beds, which lie above each other

other in a kind of thick banks, incline towards the sea in an angle of thirty-five degrees. They are intersected in different directions, sometimes transversely, by veins several inches in depth and thickness, of a very white, hard stone, the grain of which is so fine and close, that, at first view, one is apt to take it for fat quartz.

All these black fissile stones are calcareous, containing only a twenty-eighth part of argillaceous earth, mixed with a very small portion of magnesian earth. The white veins consist of pure calcareous spar.

The stone is burnt in a kiln formed on the spot, and yields a lime of very good quality, but which, to render it more active, is mixed with an equal proportion of a somewhat purer stone, found in the isle of Lismore, and carried in boats to the foot of the kiln. The mixture is effected by calcining them together.

It is of importance to know this beforehand; for the stone of Lismore, having almost the same colour and the same fissile texture as that of Oban, and being placed beside each other at the foot of the kiln, one might be easily led into the error of supposing that they are found in the same place. I did not observe

observe in either of them, any vestige of marine bodies.

ARGILLACEOUS SCHISTI.

Proceeding along the shore to the left, and passing below a single house belonging to Mr. Cambel, one reaches a ledge of craggy rocks, lying in an inclined plane, and completely bare for a space of several miles. The sea beats upon it so furiously, that it has every where torn and furrowed this kind of natural mole, though formed entirely of hard rock.

This excursion should be made during the ebb-tide; for the beds of rock have so rapid a descent towards the sea, the surf is so violent, and the waves rise so high with the least wind, that to visit the place at any other time would be attended with evident danger.

Here prevails almost the same order of things, the same disposition of the fissile beds, the same colour of stone, and the same white veins, as in the calcareous quarry already described. But the proportion of the constituent parts is completely inverted. The stone of this vast tract makes but a slight and short effervescence, with nitrous acid; the calcareous earth scarcely forms a twenty-eighth

eighth part of its composition ; and the remainder is a mixture of a quartzose and ar-laceous earths, with a very small portion of magnesia. The white veins, instead of calcareous spar, are of white semi-transparent quartz, which strikes fire copiously with steel, and does not make the least effervescence with acids.

But it deserves to be remarked, that though the disposition of the beds and the white veins is the same as that of the lime-quarry, there are also seen other slender veins, of a matter like that of the beds themselves, interrupting their course, and crossing them in various directions.

These veins, some of which are more than a foot thick, are themselves divided into a sort of net-work chinks, of a triangular, quadrangular, or rhomboidal figure, and these interstices are filled with threads of white quartz, which have a very showy appearance, on the black ground of the stone.

It may be presumed, that this intersection of the beds owes its first origin to sudden depressions of the earth, which have broken it into chasms ; and that these have been subsequently filled with some stony matter which,

which, by shrinking and cracking itself when in a soft state, has produced this mosaic work, these sportive fancies of nature, which affect a sort of regularity.

Some portions of these veins may be broken off, which are worthy of a place in the cabinets of the curious. These remarkable pieces are formed sometimes in quadrilateral prisms, from seven to eight inches long, and three inches thick, and these prisms are themselves divided into a multitude of small rhombuse, which seem as if soldered together by some lineaments of white quartz.

On ascending this rugged tract to a certain height of the mountain against which it reclines, the same matters again make their appearance. But the fissile beds resume the horizontal direction; the colour of the stone is not so black; the texture is softer, and the argillaceous earth is found in a greater quantity.

The appearance of the place seems to indicate that the steep crags which I have mentioned, however considerable in extent, have once belonged to the neighbouring mountain; from which they have been detached by some great convulsion, or what

is still more probable, by the continued action of water, fretting and undermining their basis.

To complete the whole, on proceeding about forty toises up the entire part of the mountain, and where the horizontal position of the strata shew that they have not been removed, there appear some real volcanic products, which form a new order of things; which I shall take notice of presently. But I ought first to mention the rocks of trapp and porphyry, which are imbedded amidst this astonishing assemblage of various substances so heterogeneous in appearance.

TRAPPS AND PORPHYRIES.

Ascending a steep path which passes by a group of four or five fisher-houses, there is a quarry, which is two hundred and sixty feet above the level of the sea, and situated near an old wall on the top of the mountain, and in front of the harbour. This is the spot which ought to be selected for mineralogical observations.

This quarry presents a naked crag, more than forty feet high. The first considerable strata, that is, those which serve as a support to the others, are formed of nearly horizontal

zontal layers of a greenish stone, in general hard, a little sonorous when struck with a hard body, rather dry than unctuous to the touch, though of a very fine grain. Its external appearance is that of a hard steatites.

But on a more close examination, it is found to be a stone of the nature of trapp, which fuses with the blow pipe into a black glass, and is composed of a mixture of schorl in impalpable particles, with a little quartzose, argillaceous, and calcareous earths. The schorl is the most copious ingredient. The greenish colour of the mass proceeds from iron. The beds vary in thickness; the smallest being one foot six inches, and the largest from seven to eight feet, thick.

Several of the beds, being of a less adherent texture, have suffered a certain degree of alteration, which has rendered their grain friable.

To these banks succeed others of an appearance less greenish, and bordering on deep grey; in the substance of which are seen a multitude of small crystals of felt-spar, white, hard, and shaped in parallelopipeds.

In proportion as the rock of trapp passes into the state of porphyry, by the addition of felt-spar, the horizontal position of the strata changes

changes, or rather the matter no longer assumes the form of strata. It appears, on the contrary, in that of a large mass, divided by cracks from top to bottom. These irregular fissures, which are sometimes more than an inch wide, produce enormous blocks of a longitudinal form, which often cohere so slightly, that, losing their equilibrium, they fall with a crash to the bottom of the quarry, where they break into a thousand splinters, presenting an excellent choice of specimens, and an interesting object of study, to the naturalist.

It is deserving of attention, that the crystals of felt-spar are not interspersed through every part of the rock. There are some parts where not one is to be seen, whilst other parts are entirely covered with them. These accidental porphyries, if I may use that expression, do not affect any regular form. They seem to have been scattered at random; and appear in large irregular spots, some of which are six feet in surface, and others less.

But these spots, in which the porphyry is so distinguishable, cannot be supposed to be produced by blocks of that stone accidentally

imbodied in the substance of the trapp; for the sameness of the basis of both, and local appearances, do not admit the slightest doubt upon the subject. It is much more natural to suppose, that in the places where its constituent principles are found, crystallized in the form of salts, the union of the particles of felt-spar was effected by the laws of affinity, at an epoch when the substances which enter into the composition of this rock, were dissolved and suspended in the aqueous fluid.

Besides these porphyries, which exist in an aggregate state, one may observe here a very great variety of others in the form of pebbles, or rounded stones, which the sea throws in immense quantities upon the beach; so as to induce one to think that whole mountains of that matter have been shivered in pieces by means of some terrible convulsion. The following particulars will shew whether this supposition be, or be not, probable.

LAVAS AND OTHER VOLCANIC PRODUCTS.

The environs of Oban abound in compact lavas, of the nature of basaltes, which deserve by their position, as well as the matters they have overspread, to fix the attention

tion of those persons to whom such researches are agreeable and familiar.

These burning currents, vomited by subterraneous fires, have, at very remote periods, streamed along the flat heights, and flowed into the hollows, and the chasms of the different mountains which skirt this craggy coast. By attending to this fact, it may be possible to elucidate the state of the mountains, before the eruption of these ancient volcanos.

The lavas found here are almost exclusively of the compact kind. The basalt is, in general, very homogeneous; for, with the exception of a few specks of black schorl, which may be sometimes met with, it contains no extraneous substance. This basalt is hard, sonorous, and of a fine black colour.

In some parts the compact lava assumes the form of currents, whilst in others it projects into peaks, or vast pyramids, which seem to have originated amidst the most terrible shocks and convulsions, at a period when subterraneous conflagrations burnt and liquefied every thing within the reach of their devouring flames.

Several of these volcanic peaks are split in prismatic divisions, more or less regular,

which sometimes exhibit gigantic colonnades, particularly in the quarter opposite to the isle of *Kerera*. At other times the prisms are of a smaller size, but of a more perfect configuration.

About a mile from Oban, on the road to Dunstaffage, and by the sea-side, is a volcanic eminence, easily distinguishable by an old half ruinous castle which stands on its summit. The whole south side of this eminence is formed of an assemblage of basaltic lumps of a small size, but, in general, very round, and separable into foliated pieces adapted to each other, as far as the centre, without discovering any substance which might have served as a nucleus. On the same side, towards the right when viewed in front, are seen a multitude of small, very regular, five or six-sided prisms, the lava of which is decayed. The angles of these prisms break off by a sort of natural decomposition, and thus produce round balls, which seem to rise out of the midst of the prisms. I remarked a similar appearance in some prisms of a larger size in the environs of Glasgow.

There is also found in the vicinity of Oban, a porphyric lava, which, notwithstanding the state of fluidity it must have passed

passed through, still preserves its crystals of felt-spar; neither the white colour nor grain of which have undergone but a very slight alteration. This lava is magnetic, and may be referred to species XX, in the 77th page of the work which I have published under the title of "Mineralogy of Volcanos," and in which I have described similar lavas of the island of Lipari.

But nothing is more singular than the effects produced by a current of lava on the argillaceous schisti, which I but slightly mentioned under that title, when describing a steep craggy tract that reclines against a mountain.

On reaching the summit of this mountain, which likewise reclines against a still higher one, there appears a current of basaltic lava, which issuing from the latter, covered the flat horizontal top of the former, and then flowed from cascade to cascade along the declivity that fronts the sea.

The face of this tract evidently announces, that at the period when the lava was discharged from this ancient volcano, there already existed extensive chasms and hollows. The lava runs along the surface of the soil,

as if it had been cast on a mould, and follows all the accidental forms which occur from the summit to the base of the mountain.

This volcano was submarine ; of this it would be easy to bring several proofs. But for the sake of brevity, I shall confine myself to one only, which may be easily comprehended by the greater part of readers, and by those even who are least versant in the natural history of volcanos.

In describing argillaceous schisti of the nature of slate, in a preceding part of this chapter, I stopped at their point of contact with a basaltic lava. I there stated, that the colour of the schistus became fainter at the height of fifty toises above the level of the sea, being rather grey than black ; that argillaceous earth predominated most in it ; and that the strata, which rapidly inclined near the bottom, were horizontal, particularly in certain parts, towards the top of the mountain.

Where these changes commence, one may easily find several places, where the beds of schistus are pretty thin, and where they are also divided into a multiplicity of forms, the most numerous of which are rhomboidal, triangular,

triangular, and quadrilateral. As these solid pieces may be easily separated; one may select several which possess the greatest regularity, though their forms are the result of mere contraction and not of crystallization.

The schisti thus shaped are certainly not volcanic products themselves, though they are found covered with lava. It is, besides, very singular, that neither their constituent parts, nor even their colour, have suffered the slightest alteration from the burning and melted mass that has closely overspread their surface. I proceed to give a proof of this. These schisti are of such a nature, that, on exposing one of the rhomboids taken from immediately below the lava, to the action of a pretty strong ordinary fire, it soon assumes a deep brick-red colour. The same effect would have, doubtless, been produced by the boiling lava, had it come in immediate contact with the schisti in ordinary circumstances.

It must, therefore, be inferred, that some intermediate body, such as water, diminished the action of the fire; and the most natural consequence is, that this was a sub-marine

volcano; inasmuch as it has not, in any respect, altered a substance so sensible to the operation of fire as this delicate schistus, that so rapidly passes to a red colour by the caloric oxydifying the ferruginous particles intermixed in its texture.

After having made some experiments respecting the action of ordinary fire on these schisti, whilst I was meditating upon the interesting fact, and writing my observations upon a table of lava, that rested on the schistus, in the place which I have just described, I discovered, that on passing my hand under the table, I could draw out as many as I chose of the small rhombuses of schistus. The plain reason of this was, that the lava, by contracting its bulk as it cooled, left a vacancy of several inches wide, below the slab, which was in no part above three feet thick, and which adhered by one side to a more considerable mass of lava.

As I examined these small prisms of schistous stone, several of which were three inches long, I thought of trying some of them with the loadstone. I was astonished to

to find that they were strongly magnetic on the side next the lava, whilst they were nowise so on the opposite side.

It was natural, upon this discovery, that I should endeavour to ascertain to what depth the attractive property extended.— This was effected the more easily, as the small prisms, on being dexterously struck with a hammer, split into plates of from half an inch to three or four lines thick. I was accordingly enabled, with the assistance of a very sensible magnet, to determine that the part of the schistus next to the lava, had no magnetic power beyond the depth of fourteen lines.

I then made use of powerful magnifying glasses, to examine whether the attractive parts had received any ferruginous particles by infiltration from the lava, which is itself strongly magnetic. But I could discover nothing to confirm that conjecture. The texture of these schisti appeared to me absolutely homogeneous, and of the same nature throughout; being of a fine grain, pretty soft to the touch, and without any visible particle of iron.

But if we consider that the portions of black
schorl

schorl which are found in quartz and granite, and which are not in the least magnetic in their primitive state, become so by the action of fire, as we may be easily convinced of by heating them in a common fire, and as may be seen on a grander scale in the immense quantity of schorl crystal found on Mount *Ætna*; we must conclude that the present schisti are, in part, composed of a pulverulent schorl, the general characteristics of which escape observation from the tenuity of their particles; and that wherever the heat of the lava has penetrated them, their attractive property displays itself.

These small prisms of schistous stone may, therefore, be regarded as excellent pyrometers, for determining, by comparative experiments, what must have been the heat of the lava, the effect of which was most certainly counteracted by the operation of water. For, had it been otherwise, and had not the volcano been submarine, I must repeat that the burning lava would have acted in a different manner upon the schisti. Instead of rendering them simply magnetic, which does not require a violent heat, it would have changed them to a red brick colour;

colour; and this alteration always takes place, as I have stated already, on exposing them to a pretty active fire. I have made several experiments in my laboratory, which confirm what I have now advanced respecting schisti of this kind. I reserve them for a work that will, with more propriety, admit those details, which are too minute to find a place here.

The only varieties which I was able to find in the environs of Oban, may be classed under the following numbers:

No. 1. Compact basaltic lava, pure, black, hard, without any extraneous body, fusible into black glass with the blow-pipe, and disposed in extensive currents.

No. 2. *Idem* in prisms, a number of which are united into causeways of a great height, on the brink of the channel facing the isle of Kerera.

No. 3. *Idem* in small round lumps, which exfoliate in proportion to the degree of alteration which the lava has suffered.

No. 4. *Idem* with some globules of white calcareous spar, not very abundant in general.

No. 6. Porphyric lava, forming currents;

rents, and sometimes divided into prisms, more or less regular.

No. 7. Porous lavas, of a reddish, or sometimes black-grey colour, more or less hard, and often so fusible and decayed, that they moulder into an earthy dust. These and the lavas containing globules of calcareous spar, are found only in masses of a particular pudding-stone, which I shall presently describe.

From this account it appears that the lavas remaining in their original place afford but few varieties, though they exist in enormous masses and currents. This is only what might be expected; as the craters, and the scoriated lavas which surround them, have so completely disappeared, that it is no longer possible to trace the place occupied by those terrible breaches. It should seem, therefore, that posterior to the eruption of these ancient volcanos, there must have occurred catastrophes of a different nature, which have swallowed up these dreadful orifices, and dispersed to a distance the scoriæ, pumices, ashes, and other substances discharged by the volcanos.

What remains for me to observe respecting

specting the last lithological object of the environs of Oban, may serve as a supplement to what I have now stated.

REMARKABLE PUDDING-STONES, FORMING
NATURAL WALLS OF GREAT THICK-
NESS, AND OF A CONSIDERABLE HEIGHT.

In my "*Mineralogy of Volcanos*," page 334, I thought it necessary to make a distinction between breccias and pudding-stones.

Wherever the fragments of any stone, preserving their angles, are united and agglutinated by a natural cement, I give that aggregate the name of *breccia*.

But if the stony fragments, on the contrary, have their angles flattened and worn, or are of an oval, or round form, whatever be the nature of the pieces, or of the gluten which connects them, I apply to them the denomination of *pudding-stones*.

This distinction appeared to me necessary, because it serves to mark two different modes of existence, and presents to us instructive characteristics. In fact, splinters and fragments of stone which have preserved their angular form do not indicate
that,

that, after being torn from their primitive position, they have been the sport of waves, and a long time subject to the impetuosity of currents, which might have transported them to a distance. Had this been the case, their angles would have been worn away. Their appearance, therefore, shows that they have never been removed from their original situation. But those stones which have lost their angles, and assumed forms completely similar to those produced by the continued attrition of some hard bodies, on being rubbed against each other in every direction, necessarily supposes a violent and long-exerted action, which must have carried them to a distance, or, at least, have kept them, for a long time, in convulsive agitation.

The traveller sees with astonishment, in the environs of Oban, vast walls of pudding-stone, some of which are more than two hundred feet high, and sixty feet thick. These walls extend uninterruptedly along the coast, from the right side of the harbour, fronting the sea, to a distance of more than three miles.

This kind of natural rampart forms, in
some

some parts, a dyke, which has resisted, for many ages, the impetuous fury of the waves of a sea almost incessantly agitated with tempests. In some parts it varies in its height, whilst, in others, it is detached on every side, and perfectly imitates the walls of an immense coliseum, which may be traversed and examined in every direction.

But this singular wall more generally reclines against a chain of perpendicular mountains, which surround the coast, and which it adheres to, or, as it were, incrusts. In fine, this remarkable pudding-stone, formed by a natural cement of the greatest hardness, is sometimes shaped into insulated peaks, which rise in the form of pyramids, or needles, and present the idea of grand monuments, erected by human hands. I declare, that from the time I have made natural history my principal occupation and pleasure, and during my numerous travels, I have never met with an object of this kind which so much astonished me. The pyramidical rock of St. Michael, situated in the midst of the town of Puy, in the Velai, is doubtless a very extraordinary object,

object, from its conical shape, and its great elevation. But it is composed entirely of lava, and owes its origin to a current of melted matter, which burst upwards from the earth, and settled upon itself, as it congealed by the action of the cold air. But how have these peaks, composed of inlaid substances, cemented to each other, been produced? This is a question of difficult solution. Let us try whether the different stones of which these masses are formed can enable us to propose some probable conjectures upon the subject.

THE DIFFERENT STONES WHICH ENTER
INTO THE COMPOSITION OF THE PUD-
DING-STONES OF THE ENVIRONS OF
OBAN.

1. White quartzes, sometimes reddish, of great hardness, giving fire with steel, ground and rounded on their surface, rather circular than oval, and varying from the size of a hen's egg to that of a small cannon-ball.

2. Oval and rounded fragments of greenish trapp, and of grey trapp, resembling the porphyrie

porphyric rock described above. The texture of these rounded trapps seems to be a little altered.

3. Argillaceous schistus, black, hard, and somewhat calcareous, nearly of the same nature as that found on the craggy steep which I have mentioned.

4. A black, calcareous, and somewhat argillaceous stone, resembling that of which lime is made at Oban.

I ought to observe here, that this stone, as well as the preceding, being much softer than the others, and disposed in rather thin layers, the round fragments found in the pudding-stone are never larger than a small walnut.

5. Porphyries, of greenish, grey, and yellowish grounds. The last are most plentiful; all possess great hardness; and their crystals of felt-spar, are parallelopipedal, opaque, and of a milky white. These porphyries are all round or oval, and in general of the size of one's fist, though sometimes larger. Several of them move the magnet, whilst others make no impression upon it.

6. Compact, black, basaltic lava, producing with the blow-pipe a black enamel,

attractive of the magnet. This lava, which is itself magnetic, is, in general, very found, but it is sometimes also a little altered. Its fragments are all round or oval.

7. Porphyric lava of the same form. Several pieces have suffered no injury in their texture, whilst others are altered, and even rusted. All of them, however, are magnetic.

8. Porous lava, ponderous, black, and sometimes reddish, having its cellulæ filled with calcareous spar. This lava is, in general, altered, and a little earthy.

9. Porous lava, grey, black, or reddish, the cellulæ of which are empty. These lavas are so altered, that they are friable to the fingers, and fall into gravelly powder.

All these different stones are, I repeat, rounded or oval, of a greater or less size, in proportion to their different degrees of hardness, thrown together, and intermingled without order, and agglutinated with a cement so hard, that it is exceedingly difficult to separate them with a hammer, which in general rather breaks than disjoins them.

It is not very easy to determine accurately the nature of the gluten, which has so intimately

timately consolidated these immense masses of different kinds of stone. The smallest interstices, and the least cavities, are so closely filled up with a kind of gravelly sand, consisting of a sort of *detritus*, produced by a decomposition of all the amalgamated stony substances, that it is a matter of extreme difficulty to distinguish it.

On examining, however, the most attenuated parts of this cement, with powerful microscopes, it is found that the pulverulent remains of lavas predominate in it, in general, and that a kind of lapidific juice, of a very fine and subtile nature, has joined the whole in the most intimate union. I threw some particles of this cement, which I detached with the point of a knife, into aqua fortis, and I discovered, from this experiment, that it consisted of a mixture of quartz, and of calcareous matter, in which the first is most predominant.

The more one examines this immense assemblage of stony substances rounded by attrition, the more one studies the form of these enormous masses, their position in the vicinity of lavas, and their physiognomy (if I may use the expression)—the more also are

they found to differ from the ordinary beds of pebbles, which the waters have accumulated in such great abundance in various places. One is, therefore, induced to compare them to certain volcanic eruptions, in which water, heated to the highest degree of ebullition, enters into concurrence with fire, and the different elastic emanations generated by subterraneous combustion. This may have been the cause of these sudden and tumultuous petrifications, of which the remains of ancient extinct volcanos every where afford us examples.

I am thence pretty much inclined to ascribe the origin of these astonishing ramparts and huge pyramids of puddingstone, to volcanic eruptions of a similar nature. For it must be supposed that the sea experiences furious convulsions, when its bottom is rent asunder by violent explosions and earthquakes, produced by water converted into the state of vapour by these terrible combustions. Vast quantities of matter must then necessarily be displaced; pebbles and stony fragments are united and blended with slime, sand, and volcanic rubbish of every sort, which act as a cement; and

and there thence result solid masses, which are enabled to adhere together afterwards, by the effect of a gluten so much the more tenacious, as it is produced by the two most active solvents known, namely, fire and water.

Important consequences might, doubtless, be drawn from such interesting facts. But those naturalists, who are particularly conversant in the natural history of volcanos, will be better able to comprehend and to apply them than I am. Besides, this is not the place to enter upon such a discussion, of however great importance it may be. I am rather apprehensive that I may be accused of having already entered into details which have been perhaps too minute. But the mountains, and the lithology, of the environs of Oban presented objects so interesting, both from their variety and position, and which were so little known, that I conceived that naturalists would be somewhat obliged to me for giving them an account of my researches.

OF THE SCOTCH PARSLEY, OR *LIGUSTICUM SCOTICUM*.

IT now remains for me, before taking leave of the mountains of Scotland, to mention a plant, which is in high repute among the natives of the country, as well for the medical virtues which they ascribe to it, as for its various culinary uses. This plant is the *ligusticum Scoticum* *, which I found growing by the seaside in great abundance, both in the environs of Oban and Inverary.

Robert Sibbald, in his work entitled *Scotia*

* *Ligusticum Scoticum*. Lin. L. Foliis bitter-natis. L. Sppl. pag. 359. L. Foliis duplicato ternatis. L. Hortus Cliffortianus, 97. Flora Suzæ. 232. 244. Iter Wgoth 182. cum descriptione. *Apium maritimum*. L. fl. lapp. 107. *Ligusticum Scoticum appii folio*. Tournefort, inst. 324. *Apium maritimum quibusdam, potius imperatoriae affinis planta*. Sibbald. *Scotia. illustr.* t. xiii. fig. 3, mala *Ligusticum humilium Scoticum a maritimis*. Seu *apium maritimum dulce Scoticum*. Pluk. Alm. 217, t. xcvi. fig. 2. mala. *Seseli maritimum Scoticum*. Herm. p. 227, t. ccxxvii. Rivin. Pent. Ireg. t. 59. *Apium Scoticum, et apium marinum quibusdam*. I. Newton. Rai Hist. 447. *Æder Flora Danica*, t. ccvii. Gunner *Flora Norvegica*, p. 85. *Angelica Scotica*, petiolis foliorum tripartitis, ramificationibus, pininatis trifoliatis, foliis rhombeis, incislobatis, ferratis. Lamark, *Encycloped. Meth.* tom. i. p. 173.

Illustrata,

Illustrata, published at Edinburgh, in 1684, was, I believe, the first who described and gave an engraving of that plant. The description, however, is but indifferent, and incomplete, and the figure is badly finished.

Pluknet has also given a representation of it in his collection, page xcvi. But it is engraved from an incorrect drawing, which does not present a true likeness of the plant.

This want of a good representation of it, has induced me to give one in the present travels, which so often treat on subjects of natural history. I publish it with the greater pleasure, as my intention has received the approbation of three of our most celebrated botanists, Jussieu, Lamark, and Desfontaines, for whom I entertain as much respect as personal friendship.

The plant is drawn by Marechal, an excellent painter in natural history, and engraved by Sellier, whose talents in this line are well known. (See plate III.)

Ray, to whom James Newton had transmitted some account of the uses of this plant, states, that the latter was informed in the country that the highlanders of Scotland ate some *ligusticum* every morning, in the persuasion

suasion that it was an antidote which would preserve them from all sickness during the day. “ *Mibi (inquit) ibi notum est, Scotos montanos, apud quos copiose oritur, quotidie mane eam esitare, quo se tutos esse persuadent toto die a quavis contagione.*” Rai, Hist. 447.

Gunner says, in his *Norwegian Flora*, that this plant, and also the common lovage, intermixed with salt, are administered to cattle as a preservative against all diseases. “ *Folia bujus, vel et ligustici levistici, plantæ hortensis, cum sali peccoribus ut remedium preservativum dantur.*” Gunner, Norw. 85.

The most modern botanist who has mentioned the properties of the *ligusticum* of Scotland, is John Lightfoot, in his *Flora Scotica*. He speaks of it as follows:—
 “ This plant grows on the rocks by the sea-
 “ side in many places, as on the coast of
 “ Fife, between North and South Weems,
 “ and below Kinghorn, and frequently in
 “ the western islands of Jura, Ilay, Iona,
 “ and Sky; in which last it is called by the
 “ name of *shunis*, or *siunas*, gaulish; and is
 “ sometimes eaten raw as a sallad, or boiled
 “ as greens. The root is reckoned a good
 “ carminative.

“ carminative. An infusion of the leaves
“ in whey is given to their calves to purge
“ them. The dose is ʒvii.” *Lightfoot,*
Flora Scotica, part II. p. 205, tab. 24.

This is all the information I have been able to collect respecting this plant, which the Scotch highlanders, and the inhabitants of the Hebrides, regard as a kind of universal panacea. In France, our angelica was formerly held in pretty much the same estimation; it was extolled above every thing: and it ought to be observed, that the *ligusticum* of Scotland is ranked, by Lamark, among the angelicas.

END OF THE FIRST VOLUME.

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in which is given to their calves to purge
them. The dose is "viii. Lijgals."
Pharmacopoeia Scot. Part II. p. 205. tab. 24.

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ought to be observed, that the vegetable
of Scotland is ranked, by Linnaeus, among
the angustifoliae.

END OF THE FIRST VOLUME

